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SUSTAINABLE DEVELOPMENT: TRADE AND ENVIRONMENT - THE IMPACT OF ENVIRONMENT-RELATED POLICIES ON EXPORT COMPETITIVENESS AND MARKET ACCESS

Report by the UNCTAD secretariat

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CONTENTS

		Paragraphs
I.	INTRODUCTION	1-7
II.	PRODUCT MEASURES AND MARKET ACCESS	8-50
	A. Technical regulations: the case of food standards	9-10
	B. Emerging product policies	11-17
	C. Packaging	18-24
	D. Eco-labelling	25-30
	E. The experience of developing countries	31-40
	F. Conclusions and recommendations	41-50
III.	PROCESS STANDARDS AND COMPETITIVENESS	51-92
	A. Introduction	51
	B. Compliance with domestic environmental regulations	52-79
	1. Experience of industrialized countries	54-58
	2. Experience of developing countries and countries in transition.	59-72
	3. Impacts on trade and industry relocation	73-79
	C. Conclusions and recommendations	80-92
IV.	ENVIRONMENTAL FACTORS AS TRADING OPPORTUNITIES	93-100
	A. The environmental sector	93-95
	B. Trade in pollution abatement equipment	96-100
V.	SUMMARY AND CONCLUSIONS	101-108

I. INTRODUCTION

1. At the second part of its thirty-ninth session, the Trade and Development Board, by its decision 402 (XXXIX), decided, inter alia, to consider a topic under the topic "trade and environment" at the first part of each of its annual sessions. At the first part of its fortieth session the Board selected the theme "The impact of environment-related policies on export competitiveness and market access" for consideration at the first part of its forty-first session.

2. In the last few years there has been a resurgence of interest regarding the effects of environmental policies on export competitiveness and market access. There are several reasons for this. First, since environmental policies are becoming more stringent and more comprehensive, their potential effects on market access and competitiveness are becoming greater. Second, with the growing integration of the world economy, domestic policies, including environmental policies, may increasingly have consequences on international trade. Thus increased attention is likely to be paid to the competitive effects of environmental policies in the post-Uruguay Round period. Third, the environmental quality of products and production processes is becoming more important as a factor in international competitiveness and may increasingly influence business strategies. Growing attention is being given to the role of environmental standard-setting as an instrument to induce technological innovation and to improve trade performance. Fourth, environmental policies, standards and regulations, apart from contributing to environmental improvements, are the major driving force of the "environmental sector", which is seen as a source of market opportunities and job creation.

3. Environment policies can contribute to sustainable development by correcting unsustainable patterns of production and consumption and by conserving and enhancing the natural resource base needed for improving the quality of life of present and future generations. Environmental endowments, assimilative capacities, social and intertemporal preferences have an important bearing on the environmental priorities of a country. In other words, the stage of development of a country will affect the choice of present and future environmental policies and goals.

4. Generally, environmental improvements will be possible only at an economic cost, at least in the short run. Fuller cost internalization requires government policies, including standards, regulations, market-based instruments and other measures. When environmental benefits are taken into account, environmental policies and measures may have a net positive economic effect at the national level.

5. Environmental policies also have effects on private costs of production at the sectoral level. It can be argued that even if some firms or sectors within a nation become uncompetitive in their export markets, others may gain and thus the nation's overall productivity may not be affected and may even increase. If environmental policies do lead to sectoral displacements, dynamic economies can more easily facilitate shifts from one economic sector to another. However, developing countries which are lacking a diversified export structure and infrastructure may find it difficult to maintain their export earnings in the face of an increasing number of environmental constraints.

6. Consequently, the potential trade and competitiveness effects of environmental policies remain an area of concern and a potential source of friction. This relates particularly to the issue of whether stricter and more comprehensive environmental standards may unduly restrict market access or may serve as a garb for protection of domestic industry.

7. Since the linkages between environmental policies, export competitiveness and market access will continue to be the subject of attention in UNCTAD and elsewhere, the secretariat has considered it appropriate to provide in this report a broad overview of the relevant issues and to indicate possible avenues for further policy analysis and (intergovernmental) action. The structure of the report is as follows. Chapter II deals with environmentally-related product

measures. It focuses on newly emerging "product policies", which tend to broaden the scope of environmental effects being addressed and to enlarge the variety of policy instruments being used. It includes separate sections on eco-labelling and packaging. Chapter III analyses the effects of process standards and regulations on competitiveness, particularly of developing countries. Chapter IV tries to define the "environmental sector" and analyses new market opportunities which may be created for environmental goods, including pollution abatement equipment and "environmentally preferable" consumer products. The summary and conclusions are contained in Chapter V. A statistical annex will be issued separately.

II. PRODUCT MEASURES AND MARKET ACCESS

8. Technical regulations on products are established to protect public health and the environment of the importing and consuming country, and may raise questions of market access. A number of countries are now putting increased emphasis on "product policies". The purpose of such policies is to encourage producers, retailers and consumers to reduce continuously the environmental impacts of products. Newly emerging product policies tend to focus on a variety of environment-related factors: raw material and energy intensity, reusability or recyclability; and use a range of policy instruments, some of which have emerged only recently. In addition, where life-cycle analysis (LCA) is used, both product and process-related environmental effects may be addressed.

A. Technical regulations: the case of food standards

9. Among technical regulations, food standards probably have the greatest impact on exports from developing countries. A recent study undertaken for UNCTAD, analyses, inter alia, the possible effects of United States food standards, particularly pesticides standards, on developing countries. It makes the point that the absence of a comprehensive, universal, harmonized set of pesticide residue regulations creates problems for exporters. A country's export markets may have different sets of pesticides registered for use from that prevailing in the producing country (as appropriate pesticides depend on climate, crop, pest infestations, etc.), or the same pesticides may be registered, but tolerances are established for a different set of crops.

10. The study also showed the role of a large market in influencing foreign product standards. For example, in five countries (Chile, Costa Rica, Dominican Republic, Guatemala, Mexico), foreign government authorities try to ascertain the status of the pesticide in the United States (i.e., registered or not) in making their own registration determinations, and often prohibit the use of pesticides whose use has been banned or suspended by the United States Environmental Protection Agency. A more detailed discussion of the impact of technical regulations on trade, is presented in section E, in the context of the experience of developing countries.

B. Emerging product policies

11. While environmental policy-making continues to focus on the environmental effects of industrial activity (see chapter III), concern for the environmental impacts of products has grown in recent years. Increased emphasis is put on "non-point" sources of pollution, such as households and small firms. Since it is difficult to control non-point sources of pollution directly, innovative measures may be needed.

12. Widespread public concern over hazardous substances in products has meant that in some countries, such as the United States, bans on certain substances may be easier to legislate than technical standards involving complex risk assessment. Banning the use of certain hazardous substances in products can obviously affect market access for products exported from developing countries. Moreover, because of the imprecision of the existing techniques of measurement, technical standards on hazardous substances may be difficult to implement. In such cases certification at the level of the producing firm has to be relied upon. This raises the question of the credibility of firms that are certifying the level of hazardous substances. For small firms in developing countries,

certifying that regulatory requirements regarding prohibitions and maximum concentrations of hazardous substances are complied with, may prove to be expensive and difficult. Thus technical assistance may be needed to ease the process for small firms.

13. There is increasing concern with reducing energy use in relation to consumer products. Energy standards are implemented in two basic ways: either products not meeting the standard are denied access to markets; or products are made subject to labelling provisions, with the consumer left free to decide whether to consume high or low energy efficient products. The former will obviously affect the market access of exports from developing countries, while the latter will influence their competitiveness. Where LCA is used, the total energy content of products is becoming increasingly important. This may raise the question of comparability of different sources of energy.

14. Product policies are also emerging in the area of waste management. Waste can be reduced at source by redesigning a product in order to use less materials and thus to reduce the amount of waste at disposal (normally this implies reducing its weight) or to increase its durability and reparability in order to require less frequent replacement. Waste minimization policies tend, however, to focus on recycling, requiring not only the promotion of recyclability of products but also the creation of a market for recycled materials, for example by stipulating that products contain a minimum amount of recycled materials. Developing (and other) countries therefore pose the question whether or not recyclability rather than recycled content of imported products may be sufficient to meet the environmental requirements of the importing countries.

15. Obviously producers and consumers need information for their efforts to reduce environmental impacts. The need to provide such information may of itself induce producers to improve the environmental quality of a product for reasons of competitiveness. Labelling for environmental reasons has emerged as an important instrument of environmental policy-making. Providing information on environmental impacts may involve additional costs, particularly in developing countries where testing, measuring and research may not be so well developed.

16. Greater use is now being made in many countries of economic instruments, including taxes, product charges, levies, deposit refund systems and various forms of penalties. The effect of these economic instruments on market access and competitiveness will in part depend upon the relevant price, income and substitution elasticities. For example a border tax imposed on tropical timber products would result in export losses not least because there is a high degree of substitutability between products made from tropical and from temperate timber.

17. One of the important newly emerging policies is the use of the concept of producer responsibility for products at different stages of their life cycle, e.g. by obliging producers to take back products after use. Take-back obligations are intended to induce producers to reduce waste generation at source and to use materials which are suitable for reuse or recycling. Taking back products to their countries of origin would not be a realistic option. Alternatively, a legal liability may be introduced for defective products that cause damage to the environment.

C. Packaging

18. One of the fastest moving areas of environmental policy-making with possible trade effects is that of packaging. A number of countries have implemented broad policies, covering various categories of packaging materials and setting targets for reducing packaging waste over a certain time period. Broad policies are based on mandatory recovery and recycling systems, as well as voluntary industry agreements. In other cases policies focus on packaging for specific purposes, such as beverage containers, or on specific substances, such as polyvinyl chloride (PVC).

19. A number of specific administrative procedures in the area of packaging imply that producers and/or importers have to incur increased costs, e.g with take-back obligations. Deposit/refund systems may also involve administrative

costs.

20. Compliance costs refer to the costs of changing the design of packaging, and/or the materials used, in order to comply with the environmental regulations of the importing country. An important part of compliance costs may be related to the elimination of hazardous substances from packaging materials or requirements regarding recyclability. Recyclability requirements, in practice, may imply the elimination of certain materials or a shift to alternative packaging materials. Measures used to create a market for recycled packaging, such as recycled content provisions, may oblige exporters to import used packaging. This would be inefficient from both an economic and an environmental point of view. Compliance with recycled content requirements may be particularly difficult for developing countries, considering that waste management tends to be less developed and recycling facilities scarce.

21. Differing packaging regulations in different countries may cause transaction costs to obtain information and to adapt to the different requirements in each market.

22. Packaging regulations may induce waste recovery in excess of domestic consumption. For example, the German Packaging Law as well as waste recovery in other countries have contributed to substantially reduced prices of waste paper. Producers of recycled paper, in particular domestic producers, can benefit from substantially reduced secondary raw material (waste paper) costs. However, the competitiveness of companies which collect and sell waste paper, as well as manufacturers and exporters of virgin pulp and paper in other countries, can be adversely affected. Collection, sorting and recycling of waste paper in developing countries could be adversely affected by imports of waste paper at very low prices.

23. New packaging policies may induce exporters to substitute certain materials for others even if they are inherently more environmentally unfriendly. Importers tend to prefer materials which are more easily recyclable, given existing recycling facilities. The preference for easily recyclable materials may also create obstacles for packaging using a mixture of different materials. Indeed at times developing country exporters perceive that they are forced to use materials which are inherently less environmentally friendly than traditional materials.

24. The transaction costs resulting from differences in packaging requirements in different countries make harmonization desirable from a trade and efficiency point of view. Member states of the European Union are seeking to harmonize national regulations. A draft directive on packaging has been formulated to this effect. Member States will be permitted to adopt higher targets than those laid down in the directive, provided that distortions to the internal market are avoided and that other member States are not hindered in their efforts to achieve their own targets. The difficulties in harmonizing packaging regulations are reflected in the fact that a number of countries have already requested derogation of the directive.

D. Eco-labelling

25. The purpose of eco-labelling is to promote the consumption and production of products more friendly to the environment by providing consumers with information on environmental impacts and by stimulating market forces.

26. A number of concerns have been raised. First, the increasing number of national eco-labelling schemes could affect foreign producers, in particular small-scale exporters who may face difficulties in adjusting to the requirements of different markets. Second, there is concern about possible de facto discriminatory effects of eco-labelling schemes. Third, doubts have arisen regarding the practical application of life-cycle analysis (LCA).

27. In the past, eco-labelling tended to focus on product categories which were relatively less important in terms of international trade and, in

particular, did not frequently cover products of export interest to developing countries. Consequently, potential impacts on developing countries were usually small. An exception could be found in the pulp and paper sector. However, eco-labelling is becoming more important for developing countries. For example, the European Union is in the process of establishing eco-labels for products such as certain textiles (in particular T-shirts and bed linen) and footwear, which are to a large extent supplied by developing countries. There are also several proposals for eco-labelling in (tropical) timber.

28. Eco-labelling promotes product differentiation on the basis of environmental quality and may have effects on competitiveness. Since eco-labelling is voluntary, exporting firms have the option of either applying for the label or competing on the market for unlabelled products (focusing competitiveness on price factors). However, for certain product categories, exporters from developing countries may be compelled to obtain a label or find themselves losing market shares.

29. Eco-labelling criteria increasingly focus on production processes and raw material usage in developing countries. For example, with regard to product categories such as footwear and clothing, upstream environmental impacts (such as water pollution by leather tanning industries) may be considered as being as important or more important than impacts at the consumption or disposal stage.

30. Criteria based on process and production methods (PPMs) may in particular affect developing country exporters, because of lack of access to the corresponding technologies, raw materials and information. For example, leather may originate in different tanneries which may use different PPM standards. While certain large-scale producers may be able to obtain their raw materials from specialized suppliers or to influence the processes used by their suppliers, this will normally be difficult for smaller firms in developing countries. Also, it has been observed that certain PPM-related criteria may be inappropriate for exporters in the producing countries.

E. The experience of developing countries

31. Policy-oriented research on linkages between trade and environment is being undertaken under a number of technical cooperation projects implemented by UNCTAD. For example, research institutes in developing countries are analysing country-specific experiences under the joint UNCTAD/UNDP project, "Reconciliation of environmental and trade policies" (INT/92/207).

32. One part of each of these studies investigates the possible trade effects of environmentally related product standards as well as consumer preferences in the industrialised countries. At the time of drafting this report, studies on trade and environment linkages in China, Colombia, India, the Philippines, Poland, Turkey and Zimbabwe were available in draft form. In the area of market access, studies so far have focused on analysing the possible effects of technical regulations; imports bans; packaging requirements; voluntary measures including eco-labelling; measures addressing global environmental problems. Some reference has been made to the possibility of improving the trading opportunities of environmentally friendly products.

33. Preliminary surveys indicate that awareness of environmental requirements varies according to factors such as firm size, relationships with foreign clients and publicity given to specific measures. In most cases information is provided by importers. Larger firms in developing countries, particularly those which deal directly with foreign buyers, may be better equipped to meet environmental requirements in overseas markets. Larger firms also have better access to information and technology. The response to environmental requirements also depends on the size of the importing market: if markets are small and environmental requirements are difficult to meet, exporters may simply look for other markets.

34. While for the export sector as a whole the studies have not found major trade distortions on account of environmental regulations and environmentally-related consumer preferences, impacts may be more significant at the sector or

product level. In the area of technical regulations, food standards as well as strict limitations on the use of certain substances are likely to have the most significant effects on market access. Among the problems reported are the costs and difficulties of testing and verification procedures; the perceived lack of scientific data for specific thresholds or limit values; and the uncertainty arising from rapidly changing requirements in overseas markets. By increasing the risk involved in export operations, environmental factors may delay investment decisions aimed at adjusting technologies to meet overseas environmental standards. Phytosanitary regulations and food standards may create market access problems on account of differing national standards, lack of transparency and inconsistent application of procedures.

35. The effects of three different trade bans have been analysed in the study on Colombia: The ban on imports of tuna fish into the United States, the ban on the use of sodium bisulfite in cleaning shrimps and a ban on the use of artificial colouring in food products. The study estimated that the United States embargo on tuna fish resulted in a loss of export revenues of between US$ 20 and 32 million.

36. Experience in complying with obligations under multilateral environmental agreements appears to be mixed. Partly as a consequence of the obligations under the Montreal Protocol, Chinese exports of refrigerators have been diminishing and the export competitiveness of other products may have been adversely affected. However, one company increased its exports of Freon-free air conditioners. In the case of Colombia, concern focuses on the adjustments required by food industries currently relying on refrigeration using CFCs.

37. The competitiveness impacts of carbon taxes have been analysed in detail in the case study on Colombia. Several scenarios with different tax rates and their impacts on different sectors have been analysed. The case study appears to suggest that carbon taxes would have the most disruptive effects on the markets for coal in Colombia. The policy implication suggested by the study is that such taxes could either be phased in over a period of time, or incorporate some modifications to mitigate their effects.

38. By and large, packaging requirements do not appear to have had much adverse impact on market access and competitiveness. In certain sectors, e.g. the fruit industry in Colombia, significant compliance costs have been reported. Packaging requirements have created uncertainty, in particular with regard to the type of packaging materials that will be acceptable to importers. The problem of lack of precise and timely information is aggravated by the existence of differences in requirements among countries. Exporters have at times incurred costs, delayed decisions, or shifted to other materials because of perceptions rather than of precise information regarding the requirements in the importing countries. In general, initial problems with new packaging requirements tend to be resolved after some time, on the basis of adjustments in the importing countries as well as experience and knowledge acquired by exporters.

39. Environmentally-related consumer preferences in overseas markets may have effects on processes and raw material usage in developing countries. Retailers may give instructions to their suppliers on how a product should be made or which raw materials should be used. For example, a number of Turkish exporters reported that importing companies require detailed information on the manufacturing process and/or undertake plant inspections.

40. Adjustments in order to comply with eco-labelling requirements could result in significant increases in both fixed and operating costs. The costs of testing and certification, particularly for the small-scale sector, could be high. However, for certain products, such as tropical timber, eco-labelling may be a way of regaining eroded markets.

F. Conclusions and recommendations

41. Product measures are primarily aimed at protecting public health and the environment of the importing country. However, they may act or be perceived as non-tariff barriers when they lack transparency when procedures are

discriminatory or complicated or when their scientific justification is weak. Since product measures are becoming more stringent and more comprehensive there is concern that the potential for trade friction may increase.

42. Case studies from developing countries show that the trade impacts of product measures have not been significant, except in specific sectors and specific product categories. To a certain extent such problems can be attributed to uncertainty caused by a lack of timely and accurate information on existing and emerging environmental requirements in overseas markets and transaction costs arising from differences in requirements in different countries. In certain cases, high capital costs and technological requirements as well as testing and verification procedures may have an adverse impact on export competitiveness. Developing countries particularly fear the trade and economic impacts of unilateral measures.

43. Mechanisms to mitigate possible negative impacts on market access and competitiveness of developing countries should be explored. International and bilateral cooperation would be especially helpful in this context.

44. Certain market access problems have arisen in the area of packaging. Such problems can be avoided or mitigated by providing adequate information and technical assistance. Adverse impacts of recycling targets on the use of certain packaging materials can be mitigated by increasing recycling facilities in the importing country and by assisting exporting countries to improve the recyclability of packaging materials. Special attention needs to be given to the promotion of trading opportunities of inherently environmental-friendly packaging materials, which are mainly used in developing countries.

45. Trends in product policies, such as the emergence of take-back obligations; the growing reliance on non-regulatory measures, including information-based instruments and self-regulation; and the introduction of life-cycle analysis may result in significant effects on competitiveness. The impacts on competitiveness may be heightened in cases where domestically available raw materials have to be substituted by imported raw materials and where product measures require process changes. Further it is worth noting that international trade rules are able to deal relatively well with technical regulations (including transparency provisions), but are less familiar with newly emerging product policies, such as those which require process changes and those which are voluntary.

46. More information on the possible effects of environmentally-based product measures is needed. UNCTAD's technical cooperation activities may help in identifying possible adverse effects on the exports of developing countries and proposing ways and means of avoiding or mitigating such effects. The policy analysis will also assist the public and private sectors in the developing countries to design business strategies aimed at exporting successfully in the light of environmental requirements.

47. Further the Ad Hoc Working Group on Trade, Environment and Development will explore areas where increased transparency, including through notification and consultation mechanisms, may be relevant.

48. Ways and means of taking the interests of developing countries into account in the design and implementation of such measures should also be explored.

49. International cooperation in the area of eco-labelling is needed to help avoid undue effects on trade on account of the emergency of many different national schemes as well as of possible discriminatory effects related to the ways such systems operate. Such cooperation could also help enhance the opportunities developing countries could derive from eco-labelling in marketing environmental-friendly products.

50. Further policy analysis of the above issues will also be undertaken under the programme of work which the secretariats of UNCTAD and UNEP plan to undertake jointly. Initially such cooperation has in particular focused on eco-labelling and eco-certification. These joint activities are being undertaken

in coordination with other international organizations.

III. PROCESS STANDARDS AND COMPETITIVENESS

A. Introduction

51. Process standards constitute a fundamental instrument of environmental policy-making. More stringent and more comprehensive process standards and regulations may result in long-term economic benefits by protecting human health and increasing productivity at the national level. In certain cases such regulations may enhance the competitiveness of affected industries, by inducing pollution prevention, ranging from better household practices to technological innovations resulting in new production processes. In general, however, since the costs of compliance are borne by individual firms, increased costs of production associated with process standards may adversely affect competitiveness at the sectoral or enterprise level. Consequently, such standards may cause competitive disadvantages to firms and sectors in the country applying higher standards than other countries. Thus questions regarding "implicit" subsidies, "eco-dumping", and "environmental" countervailing duties in order to "level the competitive playing-field" may arise.

B. Compliance with domestic environmental regulations

52. The competitive effects of process-related environmental policies vary widely from sector to sector. Pollution abatement expenditures in industries are heavily concentrated in a small number of sectors. The costs of complying with environmental regulations for manufactured products are generally expected to have relatively modest effects on international competitiveness, while that for natural-resource-based products, particularly commodities, may be more significant. Moreover, the competitive position of commodities is determined by a smaller number of factors than is the case for manufactured goods, and environmental costs are therefore likely to represent a larger proportion of production costs.

53. In order to analyse the differential impacts of environmental regulations on countries, it might be useful, from a theoretical point of view, to group countries on the basis of their export dependence on natural-resource-based products. However, since other reasons may lead to differential impacts between developed and developing countries, the following sections analyse (1) the case of industrialized countries and (2) the experience of developing countries and countries in transition.

1. Experience of industrialized countries

54. Empirical evidence shows that the costs of compliance with environmental regulations are on average relatively low. The statistical annex provides data on pollution abatement costs in selected countries. These data have been collected from various sources, using different definitions and methodologies, and are not appropriate for a meaningful comparison of regulatory strictness, or even of the relative level of pollution abatement costs in different countries. However, they provide an indication of trends and of differences in abatement costs among sectors.

55. In the United States total pollution abatement and control expenditures represent 1.7 per cent of GDP. From 1972 through 1991 total as well as business expenditures as a percentage of GDP have remained surprisingly steady. In the Netherlands, net environmental costs of enterprises in industry amounted to 0.9 per cent of turnover in 1990, compared with 0.6 per cent in 1975.

56. Capital expenditures appear to be more significant. For example, in the United States pollution abatement capital expenditures represented 7.5 per cent of total industry capital expenditures in 1991. Similarly, in the Netherlands environmental investment represented 5.8 per cent of total investment in

industry in 1990, compared with 2.6 per cent in 1975.

57. It should be noted that technological developments, such as the shift from pollution control, based on an end-of-pipe approach like retrofitting, to pollution prevention through "clean technologies", may result in savings in operating costs. Environmental investment may at times yield positive rates of return and may therefore be undertaken even in the absence of environmental regulations.

58. Environmental costs are expected to rise in future. For example, the Environmental Protection Agency in the United States estimated that environmental costs as a share of GDP would increase from 1.95 per cent in 1990 to 2.25 per cent in the year 2000. In the Netherlands, the cost of environmental protection in accordance with the Second National Environmental Policy Plan is expected to grow from 1.9 per cent of GNP in 1990 to 3.1 per cent in 2000.

2. Experience of developing countries and countries in transition

59. This section provides a preliminary analysis of the effects of environmental standards and regulations on the export competitiveness of developing countries and countries in transition.

60. Process standards and regulations in developing countries are often similar to standards in OECD countries, but their enforcement is relatively lower.

61. Environmental requirements in developing countries are becoming more stringent. Moreover, maintaining lax environmental standards and enforcement may entail greater costs in abatement, resource degradation and depletion in the future. Lax domestic environmental regulations may also encourage more inward-oriented and uncompetitive industries, which are economically as well as environmentally inefficient.

62. Environmental priorities, however, depend to a large extent on local environmental and developmental conditions. Thus priority should be given to improvements in infrastructure in developing countries. Too strong a focus in international discussions on industrial pollution could result in insufficient emphasis on basic infrastructure projects, such as sewerage and drainage systems, as a basic condition for environmental protection.

63. The fact that infrastructural investment may be the most important issue in environmental process related improvements in developing countries is further strengthened by a study of the World Health Organization. Additionally the study shows that developing countries have relatively little experience and knowledge to deal with problems of air pollution, the hazards of chemical use and wastes, ionizing radiation and noise. As these environmental problems typically fall into the ambit of the trade and environment debate, developing countries may find it relatively more difficult to combat these problems.

64. The cost of controlling emissions can vary greatly among and even within firms. Some estimates referring to OECD countries show that the cost of controlling a given pollutant may vary by a factor of 100 or more between firms, depending upon the age and location of plants and the technologies available to them. This problem is compounded in developing countries where technologies vary widely from case to case and may be quite different in the informal sector as compared to other sectors.

65. Further, the cost of controlling emissions varies between sectors. The capital costs of compliance are likely to be higher for a number of sectors, particularly the "polluting" sectors such as leather, textiles, paper and pulp, chemicals, dyestuffs, and energy. As these products generally dominate the exports from developing countries, the capital costs needed for complying with national and international standards may be high.

66. In Poland large investments will be needed in power plants, in particular the installation of flue gas desulphurization facilities. Such investments, as

well as modernization programmes aimed at abating SO2 and NOx emissions from power plants, will significantly increase energy prices. Meeting emission standards for coal is likely to raise costs by 10 to 15 per cent. Similarly, reducing pollution and limiting imports of scrap iron are likely to have an adverse impact on the competitiveness of iron and steel in Poland.

67. However, technological adaptations and modernization in the metallurgical sector are expected to have a positive impact on competitiveness. Similarly, a technological reconstruction of the cement industry would allow the sector to reduce the energy intensity of production and dust emissions. This would bring significant benefits in terms of lower fees paid for the emission of airborne pollutants, reduction of production costs and improved export prospects.

68. On average, the cost of complying with environmental regulations may not be particularly onerous for large firms in the developing countries, partly because they have access to information and technology. Studies conducted for a number of large manufacturing industries in India, for example, show that on average the capital expenditures had a payback period of about 2 to 5 years. This study, which is based on a survey of about 70 firms producing various products such as textiles, cement, footwear, engineering products, cardboard, ferro alloys, aluminium, fertilizers and chemicals, states that environmental investments may result in reduced raw material and energy requirements and greater use of wastes. In these cases, a certain reduction in costs was observed. However, where environmental investments are directed to waste water treatment or waste emission treatment, recovery of costs tend to be low or non-existent, particularly if end-of-pipe technologies are used.

69. Most studies found that, in general, the costs and ease of compliance vary according to the scale of operation for several reasons, such as inadequacies of infrastructure, information, administration, and measurement of pollution and difficulties in obtaining cleaner raw materials. Cleaner technologies may require a minimum scale of operation in order to be economically viable. Moreover, given that environmental expenditure is capital-, technology- and research-intensive, small firms may start with an end-of-pipe abatement strategy and move progressively to cleaner technologies at the process level.

70. The availability of raw materials and technologies also have a bearing on the cost of compliance. For instance, cleaner products and processes may entail the substitution of imported raw materials for domestic raw materials, particularly for industries which use chemicals as raw materials, such as textiles and footwear. Approximately half of the companies surveyed in Turkey found that environmental requirements affected the use of raw materials and intermediate goods used in manufacturing. Similarly cleaner technologies may not be readily available domestically or installing them may require scrapping existing facilities. Moreover, developing countries face considerable uncertainties as to what cleaner technologies are. Cleaner technologies are to a certain extent determined by the regulatory regimes of the OECD countries and thus the progress in cleaner technologies is extremely rapid depending on the changes in the regulatory regimes. As developing countries are followers rather than leaders in standard setting, the risk and uncertainty of installing new cleaner technologies is much higher for them.

71. Another factor which has to be considered in this context is the process of trade liberalization. One important consequence of import liberalization is increased competition in the domestic market, forcing firms to reduce production costs. Environmental investments could conflict with their objective of reducing costs, at least in the short run.

72. Specific problems in the case of many countries in transition are related to the economic reform process as well as the economic integration with Europe. A major concern in the case of Poland refers to the costs involved in moving towards harmonization of environmental standards and regulations with those of the European Union. Full membership of the Union requires compliance with environmental objectives laid down in a number of the Union's directives, for example with regard to ambient air standards as well as emission standards for industrial facilities and power plants with respect to sulphur dioxide, nitrogen

oxides and suspended dust.

3. Impacts on trade and industry relocation

73. Concerns with competitiveness have also led to fears that polluting industries will move to countries with lower standards or to countries where standards are not fully enforced.

74. Empirical studies have not shown that differences in pollution abatement costs among countries have had any significant effect on trade or on industry relocation. A number of studies have examined the trade performance of industries with relatively high compliance costs, as measured by United States pollution abatement cost data. A similar analysis has been undertaken for this report, but using more recent and more detailed information on both pollution abatement costs and international trade flows.

75. A sample of industries with relatively high pollution abatement costs, amounting to operating costs of 2 per cent or more of the value of shipments, has been created based on 1991 United States data at the four-digit Standard Industrial Classification (SIC) level. The sample includes 22 SIC sectors and 109 corresponding SITC sectors, representing some US$ 170 billion worth of OECD imports in 1991.

76. While the share of these sectors in Japanese imports originating in other OECD countries declined from 18.4 per cent in 1980/82 to 15.4 per cent in 1990/92, their share in imports originating in developing countries increased from 9.1 to 13.0 per cent over the same period. Similarly, the corresponding share in European Union imports originating in OECD countries outside the Union declined from 17.7 to 15.1 per cent, but their share in imports originating in countries with economies in transition increased from 13.8 to 18.6 per cent (the corresponding share in imports from developing countries, however, decreased from 8.8 to 7.1 per cent).

77. Intra-OECD trade in sectors with high pollution abatement costs decreased slightly (from 79.4 per cent in 1980/82 to 75.7 per cent in 1990/92). At the same time the share of developing countries and countries in transition in corresponding OECD imports increased from 14.1 to 16.5 and from 5.2 to 6.1 per cent, respectively. However, while the general trend is for industrialized countries to move out of sectors with high pollution abatement costs, a more detailed analysis shows that in many such sectors their trade shares have nevertheless increased.

78. In addition, trends in revealed comparative advantage (RCA) indices have been analysed. Disaggregated indices for 109 sectors included in the sample show that for a majority (84 out of 109), the RCA indices for OECD countries declined over the period 1980/82 to 1990/92, while that for developing countries increased for a relatively large number of such sectors (85 out of 109).

79. Trends in trade shares and RCA indicators are generally consistent with the industrial relocation hypothesis, but could equally reflect a normal pattern of industrialization whereby such industries grow at a higher rate initially.

C. CONCLUSIONS AND RECOMMENDATIONS

80. From the above it follows that focusing the debate on process standards and competitiveness on the cost of complying with domestic environmental regulations may unduly expose developing countries to pressures to adopt standards chosen by the importing country: developing countries would be forced to devote more resources to certain environmental improvements rather than choosing on the basis of their own environmental and developmental conditions and priorities. Since pressures for process-related trade restrictions are based on competitiveness concerns rather than on the environmental impacts in the importing countries, the risk of protectionist abuse is particularly high.

81. There are several measures which can help reduce the costs of process standards. For example, more flexible standards and the use of economic instruments may urge the industrial sector to look for cost-effective solutions.

82. Pollution prevention may often be more cost-effective than end-of-pipe solutions and reduce competitiveness impacts on regulated firms. There are well-known cases where investment in pollution prevention yields positive rates of return and has short payback periods. In many cases, however, the rate of return on investment in pollution prevention is either low or negative and would not be made in the absence of environmental regulations. In such cases pollution prevention may reduce but not eliminate competitive impacts on regulated firms.

83. While many easy and inexpensive opportunities for pollution prevention in developed countries may already be used, significant opportunities may nevertheless still exist. In developing countries, good housekeeping and other inexpensive solutions may still be more frequently available. In addition, widespread diffusion of existing off-the-shelf technologies may contribute significantly to pollution prevention in developing countries.

84. Trade restrictions intended to impose certain process standards on other countries risk being inefficient from an environmental point of view, as efficiency requires that each country adopt environmental policies and measures which reflect its own environmental and developmental conditions.

85. Policy measures which would enable developing countries to move to the use of more environment-friendly production methods and processes could include improved market access, international cooperation on standards, technology and finance, capacity building and special provisions for small firms.

86. Improved market access has an important role to play in moving towards sustainable development, by providing resources for environmental improvements and by increasing efficiency. Improved market access also facilitates the diversification of production and exports, thus reducing the heavy dependence of many countries on a few commodities for foreign exchange earnings. The implementation of the results of the Uruguay Round will improve market access. However, it remains important to identify areas where further trade liberalization, e.g. by reducing or eliminating tariff escalation, could contribute to sustainable development.

87. While it is recognized that it is desirable to move towards higher process standards, harmonization would not be required where the processes in question have no transborder or global environmental effects.

88. A certain harmonization of policies and approaches may however be warranted. While harmonization of standards might be encouraged where the same environmental and economic conditions prevail, in other cases a gradual upgrading of standards, linked with incentives such as the transfer of finance and technology, may be appropriate.

89. Additional financing and technology transfer are seen as twin agents of critical importance in promoting sustainable development. International sources of financing are needed to help developing country firms to overcome the fixed costs of installing environmentally sound technologies (ESTs). Infrastructural investment may be of critical importance in alleviating problems in developing countries. In such areas as poverty alleviation, where the issues are simultaneously of an environmental and developmental nature, the transfers of ESTs may require facilitating mechanisms.

90. Because of the differences in the costs of compliance between small and large firms, there may be a need to grant time- limited exception to small firms in enforcing stricter environmental standards for the industry as a whole. Economies of scale may be significant in environmental investments, and unlike large firms for which internally generated sources of financing may be available, small and medium-sized enterprises may find it difficult to obtain capital for investments due to low or negative returns. Moreover, it can be argued that small and spatially dispersed sources of pollutants need not and perhaps cannot be approached with the same sense of urgency and the same instruments as large and spatially concentrated sectors. However, where small firms are concentrated in some areas, government assistance or collective

initiatives may be required to improve environmental conditions.

91. Developing countries fear that stricter environmental regulations affecting commodity production might result in a loss of market share to competing natural-resource based producers. Fuller cost internalization might nevertheless have relatively small effects on final consumer prices and demand, since the cost of production of the commodity itself is small in relation to the costs of transport, processing and marketing. Innovative forms of cooperation between producers and consumers may thus be useful in facilitating fuller cost internalization.

92. Technical assistance and cooperation in capacity building can help developing countries in designing cost-effective instruments and in upgrading and enforcing process standards. It should be noted that the private sector has an important role to play in this context.

IV. ENVIRONMENTAL FACTORS AS TRADING OPPORTUNITIES

A. The environmental sector

93. A large and growing market exists for environmental goods and services (EGS), largely because of more stringent environmental standards. There is no generally accepted definition of what constitutes the so-called "environmental sector". A widely quoted OECD study divided the sector into equipment and related services (with four subsectors: water and effluent treatment; waste management; air quality control; and other, e.g. land remediation and noise) plus a separate general environmental services category. According to the study, the global market for environmental goods and services will grow from an estimated $200 billion in 1990 to $300 billion in the year 2000.

94. In a study by the Commission of the European Communities, the environmental sector is divided into (i) services; (ii) pollution abatement equipment; and (iii) other goods (such as CFC substitutes, biodegradable plastics, biodegradable detergents, catalytic converters, lead-free petrol, non-toxic paints, electric cars, solar energy for heating). Another study defines the environmental sector as consisting of: (i) environmental products and services; (ii) cleaner production technologies and services; (iii) multi-purpose products and services; and (iv) "environment-friendly" products (such as eco-labelled consumer goods).

95. Thus, "environmentally preferable" or "green" consumer products are also considered as part of the environmental sector. Some of the environment-friendly natural products supplied by developing countries can be considered "niche" products. More generally, products could be considered to be environmentally preferable when they use less energy and materials, and/or generate less emissions and less waste. Products which are produced using environment-friendly processes could also be defined as "green" products.

B. Trade in pollution abatement equipment

96. International trade in EGS focuses on relatively sophisticated manufactured goods, engineering and project management services, and technology licences. Although the share of such items in total environmental spending may be relatively small, it nevertheless represents a significant amount of trade.

97. In a number of OECD countries export promotion programmes target environmental protection goods, services and technology and may contribute to upgrading environmental standards in developing countries. Such activities often combine commercial and foreign environmental objectives. For example, in the United States the Overseas Private Investment Corporation has proposed an environmental investment fund to stimulate environmental investment in developing countries. The Energy Policy Act of 1992 directs the Secretary of Energy, through the Agency for International Development, "to create a technology transfer program aimed at reducing the U.S. trade deficit through the export of innovative environmental technologies", while the Export Enhancement

Act of 1992 seeks to encourage EGS exports.

98. Efforts to promote the exports of pollution abatement equipment should not shift emphasis in international aid programmes away from support to improvements in infrastructure, for example in sewerage and drainage systems, to special programmes to support exports of industrial pollution abatement equipment (See chapter III). It is also important to ensure that aid programmes and export promotion programmes do not promote the transfer of equipment which is inappropriate to the environmental and developmental conditions in the recipient developing countries.

99. In some cases developing countries and countries in transition may successfully compete in the market for EGS. Since new markets for EGS are emerging in the developing countries there may be opportunities for increased south-south trade, in particular in technologies which are appropriate to those countries. Export promotion programmes in OECD countries should take account of their possible effects on south-south trade in EGS.

100. The statistical annex provides some information on world trade in pollution abatement equipment, as defined in a recent study by the United States Environmental Protection Agency. In accordance with this definition, world trade amounted to approximately US$ 6.6 billion in 1992. It is interesting to note that Asian developing countries absorbed almost one third of OECD exports in 1992. Almost 9 per cent of Asian imports were supplied by intra-Asian trade.

V. SUMMARY AND CONCLUSIONS

101. Environment-based policies, apart from contributing to environmental improvements and the well-being of current and future generations, may bring long-term economic benefits. While there are "win-win" situations in which environmental and economic benefits can be achieved simultaneously, in many cases environmental benefits can be achieved only at an economic cost, at least in the short run. Where trade-offs exist between improved environmental quality and other social and economic objectives, costs and benefits should be carefully analysed. It is generally accepted that, in the case of intrinsically local environmental problems, priorities should be established by national governments. In addition, environmental standards are more efficient and easier to enforce when they reflect the environmental and developmental context to which they apply.

102. Environment-related product standards and regulations, in particular food standards, may create market access problems. Certain problems have been caused by a lack of timely and precise information. Improved transparency and consultation between importing and exporting countries is required.

103. Given the fact that market access and competitiveness of developing countries is largely dependent on price rather than non-price factors, the possibilities of obtaining price premiums may be limited. Thus to induce improvements in the environmental quality of the products, governments and aid agencies may have to provide assistance, at least initially. A judicious combination of regulatory measures and market based incentives may be needed to improve the environmental quality of products produced in developing countries.

104. New and innovative policies may be required to reduce the adverse environmental impacts of products and to change unsustainable forms of consumption in the developed countries. These policies tend to be based on voluntary measures for which international trade rules may not be well established. However, such policies may have an impact on international competitiveness, for example because of differences between producing and consuming countries environmental and developmental conditions.

105. The proliferation of voluntary measures in the area of product policies, particularly those which are information-based, will also result in an increased need for self-regulation at the firm level. In this context the credibility of the firm or the certifying agency in the developing country becomes important.

Some form of mutual recognition of certifiers between developed and developing countries may be needed. Technical assistance in harmonizing testing procedures will play a vital role in ensuring the credibility of the certifiers from developing countries. It may also be necessary to investigate the possibility of developing regional certifying and eco-labelling bodies, where such certification is beyond the capacity of individual developing countries. International organizations such as ITC and ISO can play a crucial role in this context.

106. With regard to process standards, the competitive effects of environmental regulations vary widely from sector to sector, and according to firm size. In general, the competitive effects are likely to be small for manufactured products, but may be more significant for natural-resource-based products. Demands for trade restrictions to offset differences in costs arising from differences in standards and regulations across countries, which are defended on competitive rather than environmental grounds, may lead to protectionist abuse. There are a number of options to reduce possible trade friction arising from competitiveness concerns.

107. Environmentally related adjustments of processes may entail higher capital costs. In most developing countries the opportunity cost of capital is very high. Coupled with the higher risk of operation linked to changing environmental requirements in domestic and external markets, firms may have difficulties in moving to higher process standards. In particular, the capacity of small firms to bear higher risks and raise additional capital may be limited. There is thus a need for cooperative efforts for small firms. Moreover, governments of developing countries may need to subsidize cleaner production at least in a temporary, clearly time-bound way, and make substantial investments in infrastructure in order to encourage the shift to cleaner technologies.

108. In addition international initiatives for the transfer of environmentally sound technologies as well as finance should be encouraged. Trading opportunities for environmental goods and services, particularly from developing countries, should be explored. International cooperation is needed to identify and support initiatives which may help developing countries upgrade process-related standards without resorting to trade measures.

NOTES

1. Report of the Trade and Development Board on the first part of its fortieth session (TD/B/40(1)/14(Vol.I)), Conclusions 407(XL): Sustainable development.

2. See: Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (VROM), Nota Product & Milieu, (The Hague, the Netherlands, December 1993) p.5.

3. C. Pearson, Trade and Environment: the United States Experience, Study undertaken under the UNCTAD/UNDP project, "Reconciliation of environmental and trade policies" (INT/92/207). (Geneva, 1993).

4. The Environmental Protection Agency (EPA) of the United States registers pesticides and specific terms and conditions of pesticide use. Additionally, the EPA establishes pesticide tolerance levels (maximum acceptable residue levels) for specific pesticides in specific foods, some of which may not be registered in the United States. See Pearson, ibid.

5. A recent study compared United States pesticide standards with those established by Codex Alimentarius Commission. United States General Accounting Office, International Food Safety: Comparison of U.S. and Codex Pesticide Standards (Washington, D.C., 1991).

6. See European Bank for Reconstruction and Development Environmental Standards and Legislation in Western and Eastern Europe: Towards Harmonization, Report prepared by Environmental Resources Management, (London, 1993).

7. A case in point is the paper and pulp eco-label which is based on LCA. Brazil complained that it used hydroelectricity, which used lower amounts of fossil fuel per unit as compared to sources commonly used in Europe. However, since the conversion factor used corresponded to the European grid, Brazilian fossil fuel consumption was overestimated.

8. A case in point is the newsprint requirement in the State of California and its effect on trade from Canada. Recycled content requirements which were imposed by California led to a decline in Canadian exports to the US. In order to meet the recycled content requirement Canada was forced to import waste newsprint from the United Staces in order to re-export to that country. See J. Grimmett, "The case of recycled content in newsprint", paper presented at an informal OECD experts workshop on Trade and Environment: Issues Pertaining to Processes and Production Methods (PPMs), 6-7 April 1994 (Helsinki, 1994).

9. While negative labelling is more commonly used as an instrument of environmental policy, a number of countries are using eco-labels which are awarded to products which comply with high environmental standards with the objective of encouraging consumers to purchase less environmentally damaging products.

10. The use of economic instruments is prevalent in the Nordic countries. For example, Sweden uses taxes on artificial fertilizers, pesticides and batteries, in order to discourage their excessive consumption and thus have beneficial effects on the environment. Switzerland intends to introduce a tax on volatile organic compounds (VOCs) and on the sulphur content of fuels in order to discourage their production and use.

11. In practice, problems relating to the obligation to take back products for recycling or reuse may be mitigated or avoided with the help of service companies. For example, in the case of the German Packaging Ordinance, the foreign producer may commission a service company in Germany (or another country) to collect packaging materials for reuse. The effects on competitiveness will then depend on the cost of such services.

12. S. Zarrilli, "Eco-packaging initiatives: impact on international trade and the special conditions of the developing countries", paper presented at the UNCTAD/SELA/ECLAC regional seminar on Environmental Policies and Market Access, 19-20 October 1993 (Bogota (Colombia), 1993).

13. See document TD/B/40(1)/6.

14. For example, in Colombia recycling of domestic paper and cardboard is reported to have been affected by imports of paper waste from the United States, Central America and Venezuela. See Gaviria et.al., Reconciliation of Trade and Environment Policies: the Case Study of Colombia, report prepared for UNCTAD/UNDP project INT/92/207 (1994).

15. As mentioned in document TD/B/40(1)6, footnote 55, certain Colombian exporters of coffee had shifted from jute to plastics as packaging material for exports to Germany, because of lack of recycling facilities. An updated version of the case study on Colombia, undertaken under the UNCTAD/UNDP project "Reconciliation of Environmental and Trade Policies" states that these problems were quickly resolved. However, the Colombian Coffee Growers Federation (FEDECAFE) fears that roasted and ground coffee might face potential problems with European packaging legislation.

16. At the moment, five countries: Belgium, Denmark, France, Germany and the Netherlands, have adopted broad policies in the area of packaging.

17. The draft directive also provides for the elaboration of common European Union standards regarding dimensions and shapes of packaging for agreed products; modular packaging for transport and distribution; specifications regarding the use of recycled materials in the manufacturing of packaging and other products; the establishment of criteria and methodologies for life-cycle analysis, requirements for the compostability of packaging. The life-cycle assessment is meant to establish a clear hierarchy between reusable, recyclable and recoverable packaging. Meanwhile, reusable and recoverable packaging waste, and in particular recyclable packaging waste, are considered as equally valid for reducing the environmental impact of packaging.

18. Greece, Ireland and Portugal consider that the recycling targets are too high. On the other hand, Denmark, Germany, and the Netherlands consider that the targets are too low. See Agence Europe, 16.12.1993.

19. See the report of the UNCTAD Workshop on Eco-labelling and International Trade, held at Geneva, on 28-29 June 1994.

20. Around 45 per cent of the value of imports from outside the Union in broad product categories earmarked for eco-labelling originate in developing countries. This estimate is based on the Harmonized System classification and may be subject to change.

21. In the case of paper, obtaining an eco-label may be necessary to maintain market shares, as is evidenced by the fact that retailers in the Nordic countries may refuse to buy paper that is not eco-labelled.

22. On this point, see the notes prepared for the second meeting of the Commission on Sustainable Development by the secretariats of GATT (E/1994/43) and UNCTAD (E/1994/47).

23. Policy-oriented studies are also undertaken under UNDP funded regional projects for Asia and the Pacific (RAS/92/034) and for Latin America and the Caribbean (LATINTRADE, RLA/92/012). The Government of the Netherlands as well as the International Development Research Centre (IDRC) in Canada have further contributed to policy analysis, in particular in the area of eco-labelling and trade. The secretariats of UNCTAD and UNEP will jointly undertake work in a number of areas.

24. A synthesis report on these studies will be prepared. Studies are also under way on Brazil, Jamaica and Thailand. Other studies will be undertaken on Cameroon, Costa Rica, Egypt, Malaysia, Nigeria, Senegal, Uganda and Vietnam.

Preliminary results and future activities will be discussed in a joint UNCTAD/UNDP workshop to be held at Geneva from 31 October to 1 November 1994. Under a similar project with UNEP, studies will be carried out on Argentina, Chile, Kenya and Indonesia (INT/93/A048).

25. The study on Zimbabwe states that this country has established an alfatoxin limit of 20 parts per billion, but that the Nordic countries are proposing to adopt a standard of 4 to 5 parts per billion. The study questions whether this difference can be justified on the basis of sound science and whether investments should be made to adapt to the Nordic standards. See J.C. Nkomo, B.M. Zwizwai, and D. Gumbo, Trade and Enviro.ment: Zimbabwe Case Study, report prepared for UNCTAD/UNDP project INT/92/207 (1994).

26. Interesting case studies are contained in Nkomo et al., ibid.

27. See Gaviria et al., op. cit.

28. For example, requirements in foreign markets have induced the Turkish textile industry to make investments in new machinery to change from chemical to mechanical shrinking of fibres.

29. Preliminary surveys in India indicate that the cost of testing and certification in order to obtain an eco-label for footwear could increase the ex-factory price of footwear by about 50 per cent.

30. See Gaviria et.al., and Intal et.al. 1994, op.cit.

31. The terms of reference of the Ad Hoc Working Group include "to identify and analyse emerging environmental policy instruments with a trade impact, bearing in mind the need for international cooperation towards ensuring transparency and coherence in making environmental and trade policies mutually supportive".

32. The Ad Hoc Working Group on Trade, Environment and Development will compare eco-labelling schemes in order to discuss concepts such as mutual recognition and equivalencies and analyse ways and means of considering the interests of producing countries when developing criteria.

33. An inter-agency coordination meeting was held at Geneva on 27 June 1994. The following agencies participated: FAO; GATT; ISO; ITC; UNCTAD; UNEP; UNIDO; WHO; and the World Bank.

34. R. Vossenaar and V. Jha, Environmentally-based process and production method standards: some implications for developing countries; paper prepared for the OECD workshop on Trade and Environment: Issues Pertaining to Process and Production Methods (PPMs), 6-7 April 1994 (Helsinki, 1994).

35. The term "eco-dumping" refers to situations where a country deliberately sets its standards at an artificially low level or does not enforce its standards in order to gain a competitive trade advantage or to attract investment. The term "environmental" countervailing duties refers to duties which would be levied on imported products to offset the differences in environmental costs of production in cases of "eco-dumping". Such duties are not allowed under GATT rules and have never been applied.

36. Konrad von Moltke, Environmental Protection and its Effects on Competitiveness, Paper prepared for the Seminar on "International Trade, Environment and Sustainable Development" Santiago, Chile, 20-21 April 1992.

37. However, these costs may be underestimated because they may consider only part of environmental protection costs. Most studies focus on industrial pollution control costs. Methodological and data constraints have prevented most studies from picking up micro-impacts. For a summary of the limitations of different studies see: Congress of the United States, Office of Technology Assessment (OTA), Trade and Environment: Conflicts and Opportunities. Appendix E. OTA-BP-ITE-94 (Washington, D.C., U.S. Government Printing Office, May 1993).

38. See Pearson, op.cit.

39. Netherlands Central Bureau of Statistics (CBS), Environmental statistics of the Netherlands 1993, (The Hague, the Netherlands, 1993).

40. Netherlands Central Bureau of Statistics (CBS), op.cit.

41. UNCTAD secretariat in collaboration with the Institute for Economic Analysis, "The role of technology in environmentally motivated structural change and the implications for international trade" (mimeo), December 1993. (Paper prepared for UNCTAD under the UNCTAD/UNDP project on "Reconciliation of environmental and trade policies").

42. Currently about one third of the compliance costs (public and private) result from regulations under the Clean Air Act, and another third from the Clean Water Act. Assuming full implementation of all existing and pending regulations and rules, clean air spending (non annualized) could increase by about 85 per cent between 1990 and 2000. Office of Technology Assessment, op. cit., p.194.

43. Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (VROM), Tweede Nationaal Milieubeleidsplan (NMP2) (The Hague, December 1993), p.27.

44. The analysis in this section draws on the country case studies undertaken under the joint UNCTAD/UNDP project. See Chapter II, section E.

45. For example, many of the emission and effluent standards in the Philippines are based on United States standards. See Intal et al., op.cit.

46. See Intal. et.al. 1994. op.cit.

47. See Intal. et.al. 1994. op.cit.

48. Morris Schaffer, Combating Environmental Pollution: National Capabilities for Health Protection, World Health Organization, 1991, WHO/PEP/91.14. Ten indicators for assessing the capacity of national programmes to control environmental health hazards were identified.

49. R. Stavins and T. Grumbly, "How to make the Polluter Pay", in New Directions for America (1994).

50. See country case studies.

51. It has been estimated that such a modernization programme for the third largest power plant, "Torow", alone would require investments of over US$ 1.2 billion. Poland country case study (1994).

52. See Poland country case study.

53. See Federation of Indian Chambers of Commerce and Industry, Sustainable Development by Enterprises (New Delhi, 1992).

54. The cost savings estimated by this study from such expenditures do not amount to much more than 5 to 10 per cent.

55. In Poland, for example, smaller enterprises may switch to clean coal of higher calorific value to reduce emission levels instead of installing emission abatement facilities.

56. See studies on eco-labelling in India and Brazil.

57. A study by the German Institute for Economic Research (IFO) indicates that investments to an amount of US$ 30 billion would be needed to achieve environmental quality in accordance with the European Union's environmental standards.

58. A comprehensive survey of studies published through 1990, conducted by Judith Dean, confirms this general conclusion. However, some trade effects and industrial relocation in specific industries with high environmental control costs or onerous environmental regulations is not ruled out. Several new studies published since Dean's review confirm the findings of earlier studies.

59. Piritta Sorsa, "Competitiveness and environmental standards: some preliminary results", World Bank, Policy Research Working Paper 1249, February 1994, and P. Low and A. Yeats (1992), "Do "dirty" industries migrate?". These studies confirmed that higher environmental standards in industrialized countries have not tended to reduce international competitiveness.

60. In this context, the United States Office of Technology Assessment (OTA) observes that chemicals and wood pulp sectors, which face high compliance costs, are highly competitive internationally with significant trade surpluses. OTA, op.cit., p.19.

61. Repetto has observed that "Issues on the international "competitive" effects of environmental standards are vastly exaggerated and should not be given a high priority for future deliberations on trade and environment policy. Competitive effects should be valued at the national level, and there is not a shred of evidence that national competitiveness is negatively associated with the stringency of environmental standards." With regard to the use of countervailing duties to deter "eco-dumping", Repetto observes that "the problems and abuses that these kinds of trade policies would invite far exceed the problem of competitive displacement they are aimed at". Robert Repetto, "High (and low) priority trade and environment issues facing the WTO", paper delivered to the European Union/United States Round Table on Environment and Trade, the Hague, 27 January 1994.

62. UNEP, Cleaner production by design, 1992.

63. For example, the adoption of reasonable environmental standards and the wider adoption of the approach that the polluter should, in principle, bear the cost of pollution, would help to avoid trade frictions over "hidden" environmental subsidies and "eco-dumping". See R. Repetto, "Trade and environment policies, achieving complementarities and avoiding conflicts" (Washington, July 1993).

64. UNCTAD and the Government of Norway, "Report of the Workshop on the Transfer and Development of Environmentally Sound Technologies", Oslo, 13-15 October 1993, (Geneva, 1993) p. 72. Some international financial mechanisms exist to assist in the funding of measures to deal with global environmental problems, such as the Global Environmental Facility and the Multilateral Fund under the Montreal Protocol. However, there are no comparable international mechanisms to facilitate the transfer of ESTs appropriate to local environmental problems.

65. Cases in point are the leather complexes which have been set up in several centres such as Kanpur and Madras in India. A leather complex spatially relocates a large number of small tanners within a specific area. Tanners buy or rent their plots within a complex. The cost of cleaning is included in the rental or purchase value of plots. Financial help from the government in the form of loans is available to tanners who wish to relocate to leather complexes. Some of these projects are in part funded by the Netherlands government. See India case study.

66. OECD, The OECD Environmental Industry: Situation, Prospects and Government Policies, OECD/GS(92)1 (Paris, 1992).

67. Commission of the European Communities, Employment in Europe, COM (90)290 Final (Brussels, 1990).

68. Government of Canada, Environmental Industries Sector Initiative, launched in 1989, in UNEP, Environment and Economics Unit, "Market-based instruments and environmental goals", Discussion Paper Number One (draft), September 1993.

69. UNCTAD's Committee on Commodities is examining issues related to improving the competitiveness of natural products with environmental advantages. This is one of the two substantive items on the agenda of its third session, to be held from 31 October to 4 November, 1994.

70. A major item in large environmental projects tends to be local expenditures, for example for local construction (e.g. waste water treatment plant construction, landfill or incinerator development, or power plant scrubber installation) or low-value materials which can often be more cheaply provided locally. A large part of environmental spending in the industrialized countries is for day-to-day operation of water and waste water utilities and refuse collection and disposal. OTA, op.cit., pp. 120 and 121.

71. Charles Pearson, "Trade and environment: the United States experience", December 1993 (paper prepared for UNCTAD under the UNCTAD/UNDP project on "Reconciliation of environmental and trade policies").

72. As discussed in the annex, it is difficult to give an accurate estimate of trade in environmental goods, particularly since international trade classification systems do not conform well with EGS categories. The principal problem is that most trade categories include both environmental and non environmental goods.

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SUSTAINABLE DEVELOPMENT: TRADE AND ENVIRONMENT - THE IMPACT OF ENVIRONMENT-RELATED POLICIES ON EXPORT COMPETITIVENESS AND MARKET ACCESS

Report by the UNCTAD secretariat

Addendum

STATISTICAL ANNEX

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CONTENTS

		Page
Introduction		3
Part I	Environmental investments as a percentage of GDP	4
Part II	Pollution abatement expenditures and operating costs for selected countries	5
Part III	Pollution control capital expenditures for selected OECD countries	10
Part IV	Trade in products from sectors with high pollution abatement costs	11
Part V	Comparative advantage analysis	14
	A. Revealed comparative advantage indices (RCA): analysis of trade in products from sectors with high pollution abatement costs	14
	B. Competitiveness matrixes: ex-post indicators of competitiveness	15
Part VI	Trade in pollution abatement equipment	23

Introduction

This statistical annex has been prepared as a background document for the report by the UNCTAD secretariat on "The impact of environment-related policies on export competitiveness and market access" (TD/B/41(1)/4), to be considered by the Trade and Development Board at the first part of its forty-first session. The structure of the annex is as follows. Part I, II and III refer to issues concerning the cost of complying with domestic environmental regulations (see report TD/B/41(1)/4, sections III.B.1 and III.B.2). Part IV provides statistical data on trade in products from sectors with high pollution abatement costs. This issue was analysed in section III.B.3 of TD/B/41(1)/4 on the impacts of environmental regulations on trade and industry relocation. Part V analyses the export competitiveness of these products. It includes an analysis of revealed comparative advantage indices of products from sectors with high pollution abatement costs and ex-post indicators of their competitiveness. Part VI refers to section IV.B of report TD/B/41(1)/4 and provides an analysis of trade in pollution abatement equipment among selected regions.

PART I

Environmental investments as a percentage of GDP
(public and private sectors[1])

	1985	1987	1988	1989	1990
Developed countries:					
Austria	..	1.7	1.7	..	..
Canada	..	..	..	1.1	..
France	0.8	1.0	1.0	1.0	1.0
Germany[2]	1.5	1.6	1.6	1.6	1.6
Japan	..	1.1	1.1	1.1	1.1
Netherlands	1.5	1.5	..	1.5	..
Portugal	..	..	..	0.6	..
United Kingdom	1.3	..	..	..	1.5
United States	1.4	1.4	1.3	1.4	1.4
Developing countries:[3]					
China	0.5	0.8	0.7	0.7	0.6
Indonesia	..	..	..	0.4	..
Republic of Korea	0.4	..	..	..	..
Singapore	..	..	..	1.1	..
Thailand	0.2	..	..	..	..

Sources: UNCTAD, on the basis of OECD, "OECD Environmental data, Compendium 1993", page 294; Phantumvanit D, T. Panayotou "Industrialization and Environmental Quality: Paying the Price", Synthesis paper No. 3, 1990; and Ministry of Foreign Trade & Economic Cooperation, China.

PART II

Pollution abatement expenditures and operating costs for selected countries[4]

The following tables provide data on pollution abatement costs for manufacturing industries classified at a two-digit international standard industrial classification level (ISIC, revision 2) for selected developed countries.

An analysis and comparison of pollution abatement expenditures and operating costs is rendered difficult because of a number of factors:

- Expenditures on pollution abatement do not reflect all environmental costs and may therefore be under-reported. For example, costs of compliance for environmental zoning, delays from permitting requirements, workplace health and safety standards are not included.[5]

- The accuracy of reporting may differ among firms. For example, while only part of the investment on a technology is attributable to environmental regulations, the whole may be reported as an environmental expenditure. Firms may over-report, or under-report, pollution abatement expenditure and operating costs to influence regulations or to influence future investment decisions of the company. Also, pollution abatement costs can be classified as such, without being directly motivated by concerns for the environment but by profit maximizing business behaviour.[6]

- Pollution abatement equipment may be of two types: "environmentally sound technologies" or end-of-pipe solutions. While the former may reduce expenditures by cutting costs and by increasing efficiency, the latter will raise costs. Pollution abatement expenditures and operating costs do not reveal this differentiation.

- Differences in definitions and methodologies complicate the comparison of pollution abatement expenditures and operating costs. Moreover, not all countries are collecting this type of data. Despite these limitations, industry-level pollution abatement expenditures and operating costs may give a rough indication of differences in compliance costs across sectors and across countries.

ISIC code	Production activity: manufacturing industry:	Australia[7], 1990-91					
		Total investment	Pollution abatement capital investment		Value of production	Pollution abatement operating costs	
		million US$		%	million US$		%
31	Food, beverages, tobacco	..	..	..	..	..	..
32	Textile etc., leather	..	..	..	..	..	..
33	Wood etc., furniture	..	..	..	..	..	..
34	Paper, print, publishing	201.8	11.1	5.5	11248.1	14.9	0.1
35	Chemicals, petroleum, coal, rubber, plastics	995.0	103.5	10.4	23430.2	71.0	0.3
36	Non-met., minerals (except petroleum and coal)	828.0	15.4	1.9	5859.3	24.4	0.4
37	Basic metal industries	400.9	64.3	16.0	16820.3	66.8	0.4
38	Fabricated metal products, machinery and equipment	777.8	5.6	0.7	34607.3	12.3	0.0
39	Other manufacturing	..	..	..	..	..	..
3	Total manufacturing	3203.4	199.9	6.2	133580.4	189.5	0.1

ISIC code	Production activity: manufacturing industry:	Canada[8], 1989					
		Total investment	Pollution abatement capital investment		Value of production	Pollution abatement operating costs	
		million US$		%	million US$		%
31	Food, beverages, tobacco	..	..	..	..	..	..
32	Textile etc., leather	..	..	..	..	..	..
33	Wood etc., furniture	..	..	..	..	..	..
34	Paper, print, publishing	2015.2	310.8	15.4	26598.8	80.2	0.3
35	Chemicals, petroleum, coal, rubber, plastics	717.1	120.8	16.8	32125.8	66.7	0.2
36	Non-met., minerals (except petroleum and coal)	..	..	..	..	..	..
37	Basic metal industries	..	..	..	..	..	..
38	Fabricated metal products, machinery and equipment	956.9	242.4	25.3	19172.3	270.3	1.4
39	Other manufacturing	..	..	..	..	..	..
3	Total manufacturing	4710.3	750.8	15.9	275413.9	515.2	0.2

ISIC code	Production activity: manufacturing industry:	France[9], 1991					
		Total investment	Pollution abatement capital investment		Value of production	Pollution abatement operating costs	
		million US$		%	million US$		%
31	Food, beverages, tobacco	5576.7	..	..	..	..	..
32	Textile etc., leather	1534.5	19.9	1.3	..	..	..
33	Wood etc., furniture	1545.2	3.9	0.3	..	..	..
34	Paper, print, publishing	3555.8	119.5	3.4	..	..	..
35	Chemicals, petroleum, coal, rubber, plastics	7929.1	411.0	5.2	..	..	..
36	Non-met., minerals (except petroleum and coal)	1948.9	54.2	2.8	..	..	..
37	Basic metal industries	3030.8	141.0	4.7	..	..	..
38	Fabricated metal products, machinery and equipment	14695.1	106.3	0.7	..	..	..
39	Other manufacturing	..	85.4	..	..	..	..
3	Total manufacturing	39816.1	941.7	2.4	..	..	..

ISIC code	Production activity: manufacturing industry:	Germany (only ex FRG)[10], 1990					
		Total investment	Pollution abatement capital investment		Value of production	Pollution abatement operating costs	
		million US$		%	million US$		%
31	Food, beverages, tobacco	5235.5	169.0	3.2	127771.9	303.3	0.2
32	Textile etc., leather	1771.4	45.8	2.6	47968.7	..	..
33	Wood etc., furniture	..	78.0	..	30164.6	..	..
34	Paper, print, publishing	3703.0	190.0	5.1	..	..	..
35	Chemicals, petroleum, coal, rubber, plastics	..	1351.1	..	..	..	..
36	Non-met., minerals (except petroleum and coal)	2538.8	154.1	6.1	30826.3	..	..
37	Basic metal industries	2964.0	333.6	11.3	60531.0	612.7	1.0
38	Fabricated metal products, machinery and equipment	29112.5	716.1	2.5	520406.6	..	..
39	Other manufacturing	247.6	5.0	2.0	4968.7	..	..
3	Total manufacturing	58541.2	3042.6	5.2	1095702.8	4697.7	0.4

ISIC code	Production activity: manufacturing industry:	Japan[11], 1991-92					
		Total investment	Pollution abatement capital investment		Value of production	Pollution abatement operating costs	
		million US$		%	million US$		%
31	Food, beverages, tobacco	..	..	..	..	..	..
32	Textile (no leather products)	1259.4	13.9	1.1	..	..	..
33	Wood etc., furniture	..	..	..	..	..	..
34	Paper, print, publishing	1934.5	79.4	4.1	..	..	..
35	Chemicals, petroleum coal, rubber, plastics	14314.3	615.1	4.3	..	..	..
36	Non-met., minerals (except petroleum and coal)	931.7	25.2	2.7	..	..	..
37	Basic metal industries	10150.0	424.8	4.2	..	..	..
38	Fabricated metal products, machinery and equipment	28503.8	469.7	1.6	..	..	..
39	Other manufacturing	7902.1	61.9	0.8	..	..	..
3	Total manufacturing	64995.7	1689.9	2.6	..	..	..

ISIC code	Production activity: manufacturing industry:	Netherlands[12], 1992 (except for value of production - 1990)					
		Total investment	Pollution abatement capital investment		Value of production	Pollution abatement operating costs	
		million US$		%	million US$		%
31	Food, beverages, tobacco	1830.5	39.3	2.1	41450.7	72.6	..
32	Textile etc., leather	208.7	27.2	13.1	4418.0	11.5	..
33	Wood etc., furniture	142.7	4.6	3.2	3114.6	4.8	..
34	Paper, print, publishing	960.6	8.4	0.9	14501.0	31.6	..
35	Chemicals, petroleum, coal, rubber, plastics	2592.6	210.2	8.1	43532.6	338.1	..
36	Non-met., minerals (except petroleum and coal)	309.9	17.7	5.7	4579.5	21.4	..
37	Basic metal industries	315.0	42.3	13.4	6004.0	55.5	..
38	Fabricated metal products, machinery and equipment	2175.1	36.5	1.7	48845.6	72.4	..
39	Other manufacturing	..	..	..	388.4	3.1	..
3	Total manufacturing	8569.8	424.1	4.9	166834.2	610.9	..

ISIC code	Production activity: manufacturing industry:	Sweden[13], 1991					
		Total investment	Pollution abatement capital investment		Value of production	pollution abatement operating costs	
		million US$		%	million US$		%
31	Food, beverages, tobacco	659.4	34.7	5.3	15035.3	41.3	0.3
32	Textile etc., leather	83.0	1.0	1.2	1709.5	4.5	0.3
33	Wood etc., furniture	406.9	21.5	5.3	8113.8	12.6	0.2
34	Paper, print, publishing	1185.1	112.4	9.5	17732.0	117.4	0.7
35	Chemicals, petroleum, coal, rubber, plastics	978.6	67.3	6.9	14642.1	64.0	0.4
36	Non-met., minerals (except petroleum and coal)	217.8	8.8	4.0	2681.1	9.9	0.4
37	Basic metal industries	351.1	23.2	6.6	7242.2	81.0	1.1
38	Fabricated metal products, machinery and equipment	2576.1	81.9	3.2	44274.2	87.6	0.2
39	Other manufacturing	15.4	1.3	8.6	304.6	2.0	0.7
3	Total manufacturing	6473.4	352.0	5.4	111847.4	420.3	0.4

ISIC code	Production activity: manufacturing industry:	USA[14], 1991					
		Total investment	Pollution abatement capital investment		Value of shipments	Pollution abatement operating costs	
		million US$		%	million US$		%
31	Food, beverages, tobacco	9767.2	487.7	5.0	419632.6	1302.6	0.3
32	Textile etc., leather	2208.9	71.8	3.3	74848.1	259.6	0.3
33	Wood etc., furniture	2302.0	164.9	7.2	110596.2	434.6	0.4
34	Paper, print, publishing	14050.1	1269.8	9.0	285508.7	1863.1	0.7
35	Chemicals, petroleum, coal, rubber, plastics	26119.3	3610.3	13.8	551070.1	5952.5	1.1
36	Non-met., minerals (except petroleum and coal)	2381.3	154.4	6.5	59610.6	464.9	0.8
37	Basic metal industries	5878.7	673.4	11.5	132836.6	2002.6	1.5
38	Fabricated metal products, machinery and equipment	34663.5	944.8	2.7	1089628.0	3647.8	0.3
39	Other manufacturing	822.1	13.1	1.6	37131.4	74.9	0.2
3	Total manufacturing	98916.4	7390.1	7.5	2826207.0	17386.8	0.6

PART III

Pollution control capital expenditures for selected OECD countries (as percentage of total investments)

Because pollution abatement capital expenditures may vary over time, time series may give a more accurate picture of the costs of compliance. The following table gives such data for three selected countries: Japan, the Netherlands and the United States of America.

Year	Japan	Netherlands	USA
1986	3.6	3.8	3.7
1987	3.6	4.5	..
1988	4.1	4.1	4.2
1989	3.2	4.0	4.4
1990	3.2	5.9	5.9
1991	3.5	4.1	7.5
Average 1988-1991	3.5	4.5	5.5

Source: UNCTAD calculations based on the Japanese Ministry of International Trade and Industry "Trends of Industrial Pollution Prevention Investment in the Private Sector", various years; U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census, "Pollution abatement costs and expenditures, 1991", January 1993; U.S. Department of Commerce, Bureau of the Census "1991 Annual survey of manufactures - Value of product shipments", November 1992; and Netherlands central bureau of statistics, "Industrial costs for the protection of the environment, 1991" (the Netherlands, Voorburg, 1993).

PART IV

Trade in products from sectors with high pollution abatement costs

The table presented below provides data on a sample of industries with relatively high pollution abatement costs, amounting to operating costs of 2 per cent or more of the value of shipments. As referred to in the report (TD/B/41(1)/4, section III.B.3), the sample is based on 1991 United States data at the four-digit Standard Industrial Classification (SIC) level.[15] The sample includes 22 SIC sectors and 109 corresponding standard international trade classification (SITC revision 2) sectors, representing some US$ 169 billion worth of OECD imports in 1991. The 109 SITC sectors are listed below.

Imports from the world and OECD in sectors with high pollution abatement costs as a share of total imports decreased from 1980-'82 to 1990-'92, while the shares of exports to the OECD originating in Latin America, Asia and countries with economies in transition, increased over the same period.

Trade in products from sectors with high pollution abatement costs - value and shares in total manufacturing exports of selected regions to OECD markets

(excluding intra-EU trade)

	Value (million US$)		Shares (in percent)							
	OECD		OECD		Japan		USA		EU	
	'80-82	'90-92	'80-82	'90-92	'80-82	'90-92	'80-82	'90-92	'80-82	'90-92
Exports \ to: from:										
OECD	61730.1	127920.6	14.3	12.8	18.4	15.4	13.5	11.5	17.7	15.1
DC	10945.2	27853.7	6.7	6.7	9.1	13.0	4.0	4.2	8.8	7.1
Latin America	4561.3	11517.6	9.6	13.3	33.6	46.7	5.8	8.1	12.3	18.6
Africa	2956.1	2706.8	16.1	9.5	48.7	47.7	9.6	1.4	16.1	10.0
Asia	3427.9	13629.2	3.5	4.5	5.5	9.5	1.9	2.6	3.7	3.8
CET	4020.3	10388.6	13.5	19.0	11.3	26.1	15.6	14.5	13.8	18.6
World	77781.7	169069.8	12.2	11.4	13.8	14.6	10.4	8.8	14.4	13.1

Source: UNCTAD Secretariat calculations based on data from U.S. Department of Commerce Economics and Statistics Administration, Bureau of the Census, "Pollution abatement costs and expenditures, 1991", January 1993 and U.S. Department of Commerce, Bureau of the Census "1991 Annual survey of manufactures - Value of product shipments", November 1992, and Comtrade data.

Notes:
DC: Developing countries, including China.
Latin America: Developing countries in Latin America and the Caribbean.
CET: Countries with economies in transition (former USSR and East European countries).
World: Excluding exports of products classified under "not elsewhere specified" (n.e.s.).

List of industries with high pollution abatement costs
SITC classification (revision 2)

SITC:	Description:	OECD imports 1991 (1,000 US$)
2331	SYNTH.RUBB.LAT.;SYNTH.RUBB.FACTICE DERIV.FROM OILS	1726294
2512	MECHANICAL WOOD PULP	442731
2516	CHEMICAL WOOD PULP,DISSOLVING GRADES	655899
2517	CHEMICAL WOOD PULP,SODA OR SULPHATE	9053284
2518	CHEMICAL WOOD PULP,SULPHITE	906417
2519	OTHER CELLULOSIC PULPS	303593
2671	REGENERATED FIBRES SUITABLE FOR SPINNING	625079
2672	WASTE OF MAN-MADE FIBRES,NOT CARDED,COMBED	74395
2786	SLAG,DROSS,SCALINGS AND SIMILAR WASTE,N.E.S.	240252
2881	ASH & RESIDUES,CONTAIN.METALS/METALLIC COMPOUNDS	1177720
3232	COKE AND SEMI-COKE OF COAL OF LIGNITE OR OF PEAT	750717
3352	MINERAL TARS AND PRODUCTS OF THEIR DISTILLATION	1239436
3353	PITCH & PITCH COKE OBTAIN.FROM COAL TAR/MINER.TARS	90933
3415	COAL GAS,WATER GAS,PRODUCER GAS & SIMILAR GASES	372
4313	FATTY ACIDS,ACID OILS,AND RESIDUES	284970
5112	CYCLIC HYDROCARBONS	1706429
5113	HALOGENATED DERIVATIVES OF HYDROCARBONS	1004082
5114	SULPHON.NITRAT./NITROSAT.DERIVATIV.OF HYDROCARBONS	181584
5121	ACYCLIC ALCOHOLS & THEIR HALOGENATED,DERIVATIVES	2563091
5122	CYCLIC ALCOHOLS & THEIR HALOGENATED DERIVATIVES	169136
5123	PHENOLS & PHEN.-ALCO.& THEIR HALOGENAT.DERIVATIVES	773775
5137	MONOCARBOXYLIC ACIDS & THEIR ANHYDRIDES,HALIDES,	1866623
5138	POLYCARBOXYLIC ACIDS & THEIR ANHYDRIDES,ETC.	987027
5139	CARBOXYLIC ACIDS WITH ALCOHOL,PHENOL ETC.FUNCTION	1647415
5145	AMINE-FUNCTION COMPOUNDS	1154855
5146	SINGLE OR COMPLEX OXYGEN-FUNCTION AMINO-COMPOUNDS	1922725
5147	CARBOXYAMIDE-FUNCTION COMPOUNDS;& OTHER COMPOUNDS	1631901
5148	OTHER NITROGEN-FUNCTION COMPOUNDS	4608173
5154	ORGANO-SULPHUR COMPOUNDS	856044
5155	OTHER ORGANO-INORGANIC COMPOUNDS	473176
5156	HETEROCYCLIC COMPOUNDS;NUCLEIC ACIDS	4991372
5157	SULPHONAMIDES,SULTONES AND SULTAMS	504695
5161	ETHERS,ALCOHOL PEROXIDES,ETHER PEROX.,EPOXIDES ETC	998361
5162	ALDEHYDE-,KETONE-,& QUINONE-FUNCTION COMPOUNDS	1130183
5163	INORGANIC ESTERS,THEIR SALTS,& THEIR DERIVATIVES	361594
5221	CHEMICAL ELEMENTS	1420553
5222	INORGANIC ACIDS AND OXYGEN COMPOUNDS OF NON-METALS	914249
5223	HALOGEN AND SULPHUR COMPOUNDS OF NON-METALS	74290
5224	METALLIC OXIDES OF ZINC,CHROMIUM,MANGANESE,IRON,	723305
5225	OTH.INORG.BASES & METALLIC OXID.,HYDROXID.& PEROX.	1971309
5231	METALLIC SALTS AND PEROXYSALTS OF INORGANIC ACIDS	1131833
5232	METALLIC SALTS AND PEROXYSALTS OF INORGANIC ACIDS	1554364
5233	SALTS OF METALLIC ACIDS, ETC.	370071
5239	INORGANIC CHEMICAL PRODUCTS,N.E.S	652033
5241	FISSILE CHEMICAL ELEMENTS AND ISOTOPES	4153292
5249	OTHER RADIO-ACTIVE AND ASSOCIATED MATERIALS	228049
5311	SYNTHETIC ORGANIC DYESTUFFS	3099613
5312	SYNTH.ORGANIC LUMINOPHORES;OPTIC.BLEACHING AGENTS	286604
5331	OTHER COLOURING MATTER,INORGANIC PRODUCTS	1084902
5335	COLOUR.PREPTNS OF A KIND USED IN CERAMIC,ENAMELLI.	949885
5622	MINERAL OR CHEMICAL FERTILIZERS,PHOSPHATIC	258833
5821	PHENOPLASTS	158770
5823	ALKYDS AND OTHER POLYESTERS	2674875

SITC	Description:	OECD imports 1992 (1,000 US$)
5824	POLYAMIDES	776409
5825	POLYURETHANES	349624
5826	EPOXIDE RESINS	530481
5827	SILICONES	441530
5829	OTHER CONDENSATION,POLYCONDENSATION/POLYADD.PRODU.	655126
5831	POLYETHYLENE	4036086
5832	POLYPROPYLENE	1404605
5833	POLYSTYRENE AND ITS COPOLYMERS	1536270
5834	POLYVINYL CHLORIDE	2197936
5835	COPOLYMERS OF VINYL CHLORIDE AND VINYL ACETATE	55214
5836	ACRYLIC POLYMERS,METHACRYLIC POLYMERS, ETC..	1219725
5837	POLYVINYL ACETATE	195405
5839	OTHER POLYMERIZATION AND COPOLIMERIZATION PRODUCTS	4506175
5842	CELLULOSE NITRATES	59890
5843	CELLULOSE ACETATES	113006
5849	OTHER CHEMICAL DERIVATIVES OF CELLULOSE,VULC.FIBR.	537119
5852	OTHER ARTIFICIAL PLASTIC MATERIALS,N.E.S.	247309
5911	INSECTICIDES PACKED FOR SALE ETC.	326742
5912	FUNGICIDES PACKED FOR SALE ETC.	465795
5913	WEED KILLERS (HERBICIDES)PACKED FOR SALE ETC.	859601
5914	DISINFECT.,ANTI-SPROUTING PROD.ETC.PACKED FOR SALE	220610
5981	WOOD- AND RESIN-BASED CHEMICAL PRODUCTS	469740
6411	NEWSPRINT	7537766
6413	KRAFT PAPER AND PAPERBOARD,IN ROLLS OR SHEETS	3471684
6415	PAPER AND PAPERBOARD,IN ROLLS OR SHEETS,N.E.S.	6735549
6416	BUILDING BOARD OF WOOD PULP OR OF VEGETABLE FIBRE	542803
6417	PAPER & PAPERBOARD,CORRUGATED,CREPED,CRINKLED ETC.	668394
6418	PAPER & PAPERBOARD,IMPREGNAT.COAT.SURFACE-COLOURED	4420480
6419	CONVERTED PAPER AND PAPERBOARD,N.E.S.	561612
6517	YARN OF REGENERATED FIBRES,NOT FOR RETAIL SAL	632595
6611	QUICKLIME,SLAKED LIME AND HYDRAULIC LIME	47308
6612	PORTLAND CEMENT,CIMENT FONDU,SLAG CEMENT ETC.	1038152
6635	SLAG WOOL,ROCK WOOL AND SIMILAR MINERAL WOOLS	333618
6649	GLASS,NE.ES.	972537
6712	PIG IRON,CAST IRON AND SPIEGELEISEN,IN PIGS,BLOCKS	806627
6713	IRON OR STEEL POWDERS,SHOT OR SPONGE	359052
6716	FERRO-ALLOYS	3982919
6724	PUDDLED BARS AND PILINGS;INGOTS,BLOCKS,LUMPS ETC.	149520
6725	BLOOMS,BILLETS,SLABS & SHEET BARS OF IRON OR STEEL	1999559
6727	IRON OR STEEL COILS FOR RE-ROLLING	3483520
6731	WIRE ROD OF IRON OR STEEL	1690143
6732	BARS & RODS,OF IRON/STEEL;HOLLOW MINING DRILL ST.	2480751
6733	ANGLES,SHAPES & SECTIONS & SHEET PILING,OF IRON/ST	1511660
6744	SHEETS & PLATES,ROLLED >4.75MM OF IRON/STEEL	2620800
6745	SHEETS & PLATES,RLD.THICKNS.3MM TO 4,75MM IRN/STL.	1209500
6746	SHEETS & PLATES,ROLLED;THICKNESS OF LESS THAN 3MM.	4029979
6747	TINNED SHEETS AND PLATES,OF STEEL	529213
6749	OTHER SHEETS AND PLATES,OF IRON OR STEEL,WORKED	3769001
6760	RAILS AND RAILWAY TRACK CONSTRUCTION MATERIAL	380880
6781	TUBES AND PIPES,OF CAST IRON	95414
6785	TUBE & PIPE FITTINGS(JOINTS,ELBOWS)OF IRON/STEEL	1708572
6794	CASTINGS OR IRON OR STEEL,IN THE ROUGH STATE	485719
6821	COPPER AND COPPER ALLOYS,REFINED OR NOT,UNWROUGHT	7711612
6841	ALUMINIUM AND ALUMINIUM ALLOYS,UNWROUGHT	9748225
7372	ROLLING MILLS,ROLLS THEREFOR AND PARTS	540327
7781	BATTERIES AND ACCUMULATORS AND PARTS	2798749

Source: UNCTAD secretariat, based on data from U.S. Department of Commerce op. cit. and Comtrade data.

PART V

Comparative advantage analysis

This part presents data on revealed comparative advantage indices (RCA) for the sample which was referred to in the report as a group of products identified with relatively high pollution abatement costs (amounting to operating costs of 2 per cent or more of the value of shipments, see also previous part of this annex). In addition, ex-post indicators of competitiveness for the products included in the sample are provided.

A. Revealed comparative advantage indices (RCA); analysis of trade in products from sectors with high pollution abatement costs

1980-1982 and 1990-1992

Region	No. of RCA		World		EU		Japan		USA	
	Upwards	Downwards	1980 - 1982	1990 - 1992	1980 - 1982	1990 - 1992	1980 - 1982	1990 - 1992	1980 - 1982	1990 - 1992
OECD	25	84	1.17	1.13	1.23	1.16	1.33	1.05	1.30	1.30
DC	85	24	0.55	0.59	0.61	0.55	0.66	0.89	0.38	0.48
LAC	86	23	0.79	1.17	0.86	1.42	2.43	3.20	0.55	0.91
Africa	69	36	1.32	0.84	1.12	0.76	3.52	3.26	0.92	0.15
Asia	80	29	0.29	0.40	0.25	0.29	0.39	0.65	0.18	0.30
CET	85	24	1.11	1.67	0.96	1.42	0.82	1.79	1.49	1.64

Source: UNCTAD secretariat calculations based on U.S. Department of Commerce op. cit. and Comtrade data.

Notes:
DC: Developing countries, including China.
LAC: Developing countries in Latin America and the Caribbean.
CET: Countries with economies in transition (former USSR and East European countries).

Algebraically the revealed comparative advantage index is defined as: $RCA_{ji}=(X_{ji}/X_{jt})/(X_{iw}/X_{wt})$ where x is export, j industry, i country, w world and t total. The revealed comparative advantage index gives an indication of a country's/region's export share of a given product in world trade of this product relative to this country's/region's export share in total world trade. An index above 1 is computed when the share of products from sectors with high pollution abatement costs in a country's/region's exports exceeds its share

in world trade and therefore indicates a comparative advantage in those exports. An index lower than 1 indicates a comparative disadvantage in the exports of products from sectors with high pollution abatement costs.

Trends in revealed comparative advantage indices were analysed. Disaggregated indices for the 109 SITC sectors included in the sample show that for a majority (84 out of 109), the RCA indices for OECD countries declined over the period 1980/82 to 1990/92, while that for developing countries increased for a relatively large number of such sectors (85 out of 109).

B. Competitiveness matrixes;

ex-post indicators of competitiveness

Market shares of products from sectors with high pollution abatement costs were analyzed over the period 1981-1991. The approach taken is based on the classification of products in four clusters[16]; two clusters indicating whether OECD trade in a specific product has been increasing or decreasing relative to the OECD's total imports (plotted from the horizontal axis of the matrices[17]) and, two clusters indicating whether or not a region's share in OECD imports of these products has been increasing (plotted from the vertical axis of the matrices[18]). On the basis of these criteria the classification of products from sectors with high pollution abatement costs was made:

- "Retreats" represent declining products in OECD trade in which a region's exports of products from sectors with high pollution abatement costs are losing their market share.
- "Waning stars" represent declining products in OECD trade in which a region's exports of products from sectors with high pollution abatement costs are gaining in market share.
- "Missed opportunities" represent increasing products in OECD trade in which a region's exports of products from sectors with high pollution abatement costs are losing their market share.
- "Rising stars" represent increasing products in OECD trade in which a region's exports of products from sectors with high pollution abatement costs are gaining in market share.

By attributing exports of products from sectors with high pollution abatement costs a product-specific combination of competitive position and market attractiveness (based on product and market share growth rates over the period 1981-1991) each product can be classified in one of the 4 categories. The matrixes, presented below, illustrate the distribution of these combinations for selected regions with each of the quadrants representing one of the four possible combinations mentioned above.

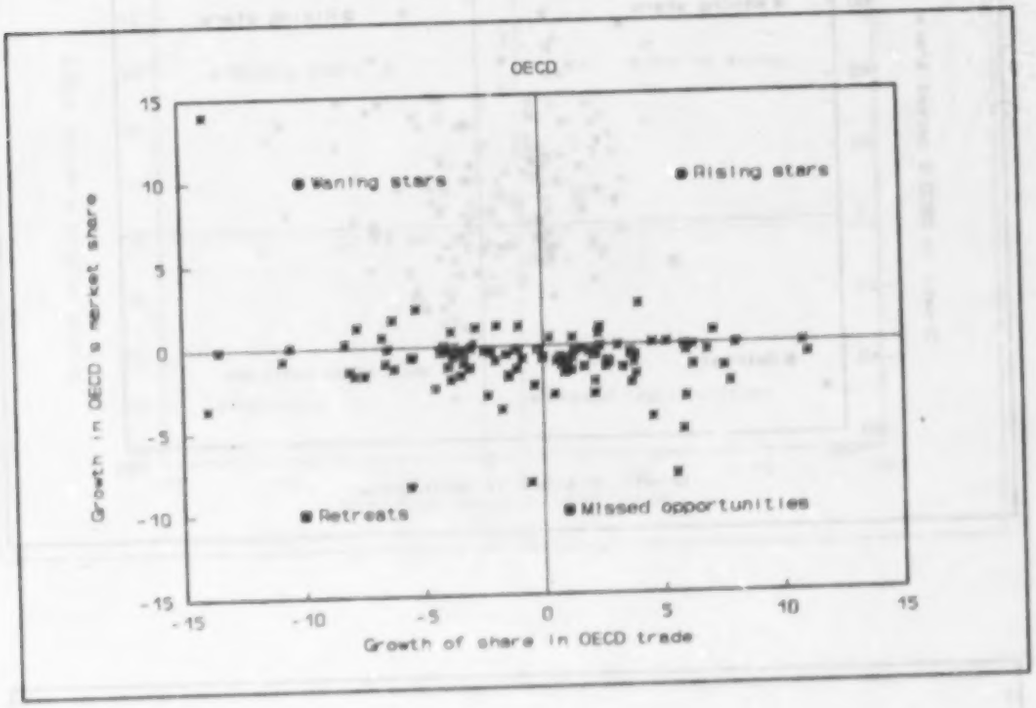
The matrixes show that for the group of developing countries, most products are grouped under rising and waning stars while for the OECD these products are characterized by a relatively low degree of competitiveness in markets of decreasing and increasing demand.

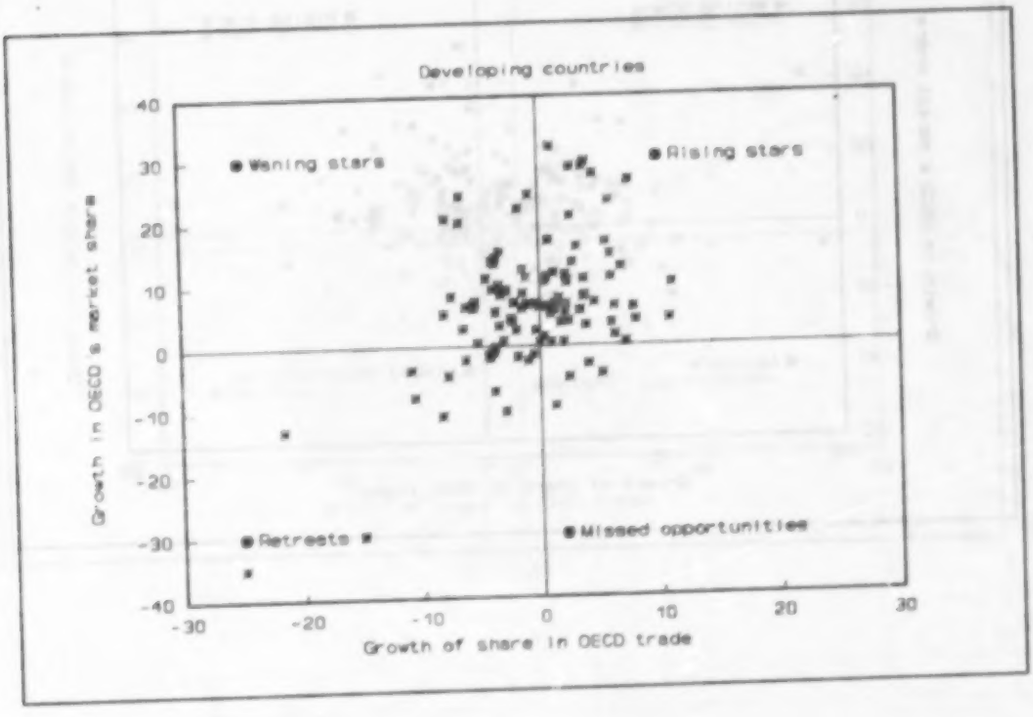
The "pie charts" indicate, for the year 1991, the amount of trade in products from sectors with high pollution abatement costs classified in each of the four groups as a percentage share of each region's total exports of these products to the OECD. For the group of developing countries, trade in products from sectors with high pollution abatement costs is more concentrated in the competitive sectors while most of the OECD trade is associated with retreats and missed opportunities.

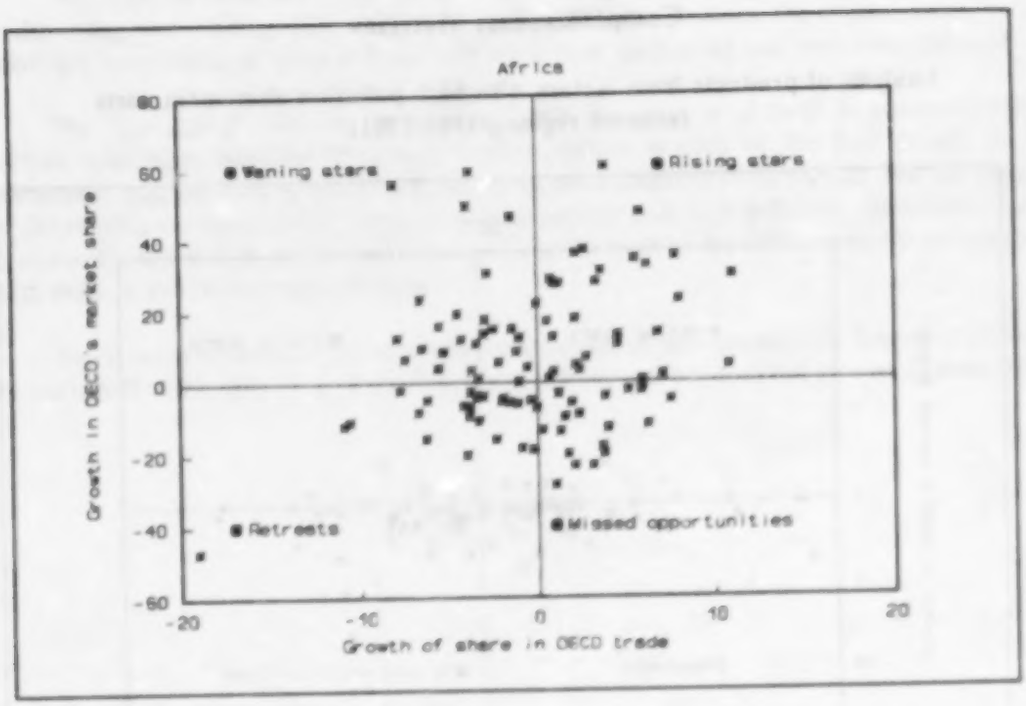
Since competitiveness is determined by a number of non-quantifiable factors it should be realized that this type of analysis reveals competitiveness but does not give an explanation.

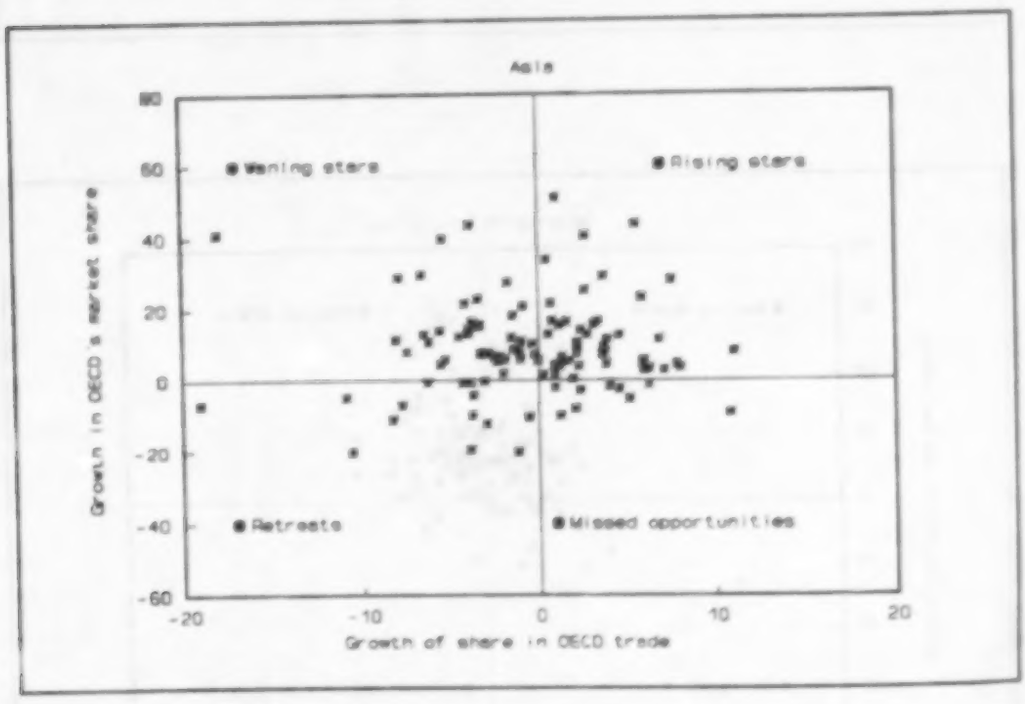
Competitiveness Matrixes

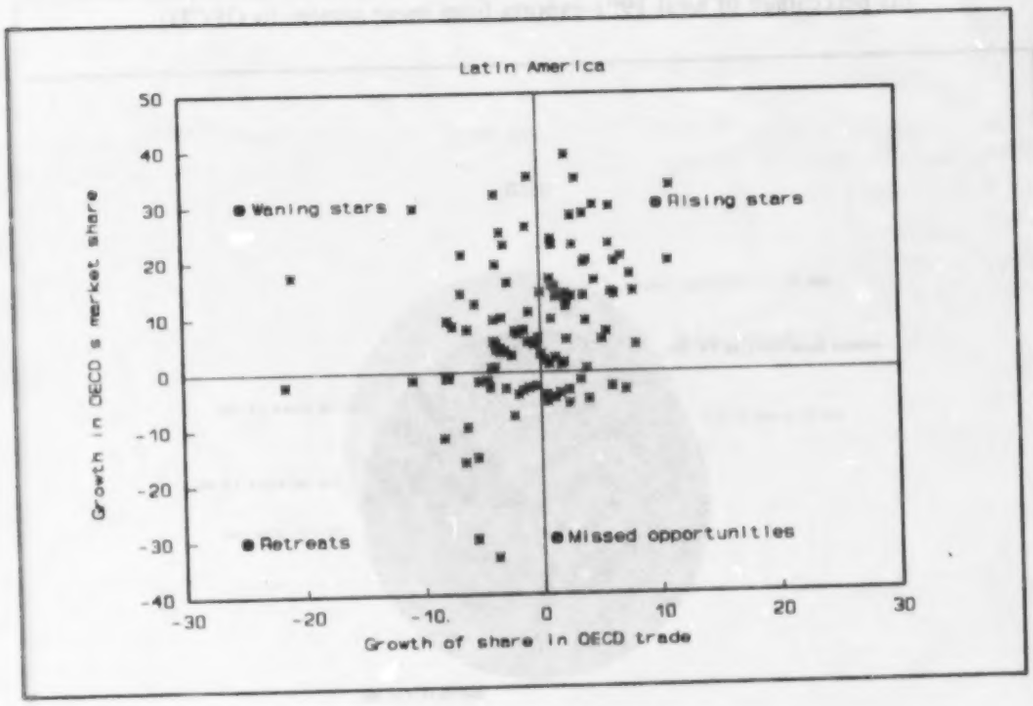
Analysis of products from sectors with high pollution abatement costs (selected regions, 1981-1991)

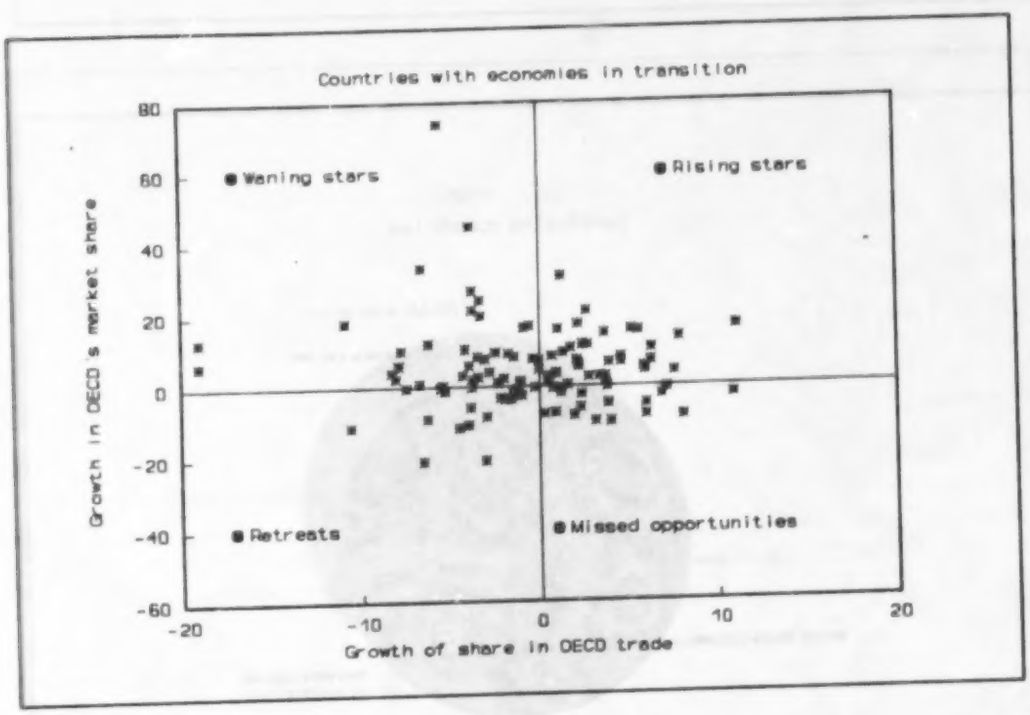





Africa
Waning stars
Rising stars
Retreats
Missed opportunities
Growth in OECD's market share
Growth of share in OECD trade
80
60
40
20
0
-20
-40
-60
-20
-10
0
10
20

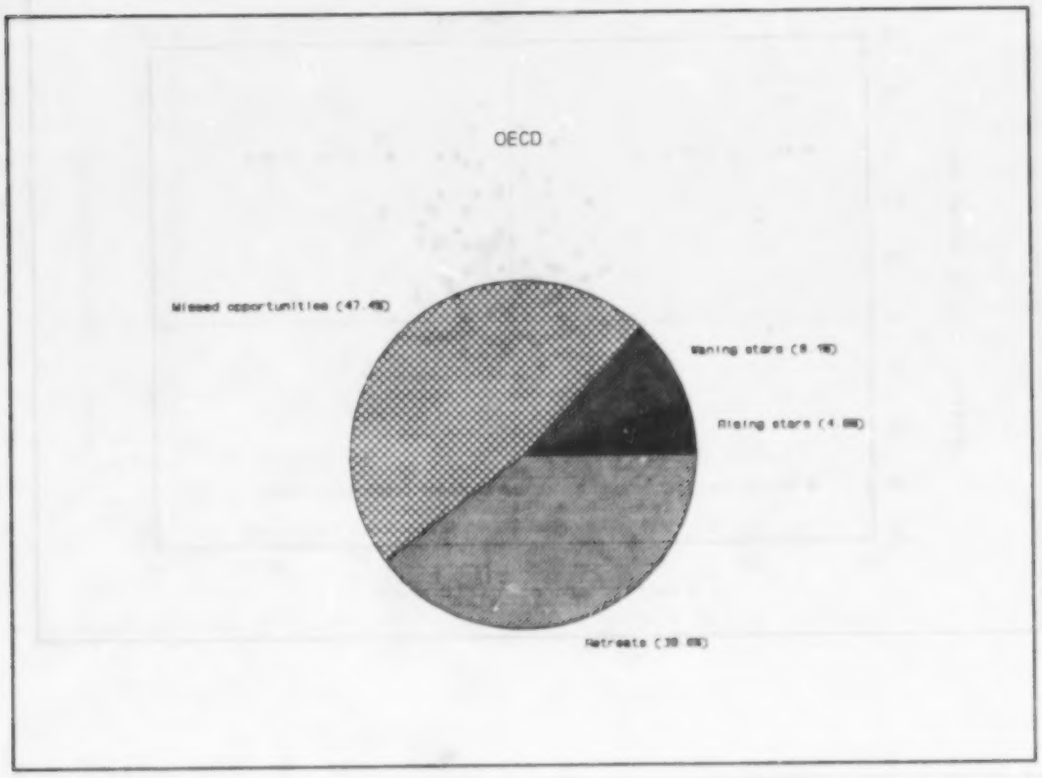

Asia
Waning stars
Rising stars
Retreats
Missed opportunities
Growth in OECD's market share
Growth of share in OECD trade
80
60
40
20
0
-20
-40
-60
-20
-10
0
10
20

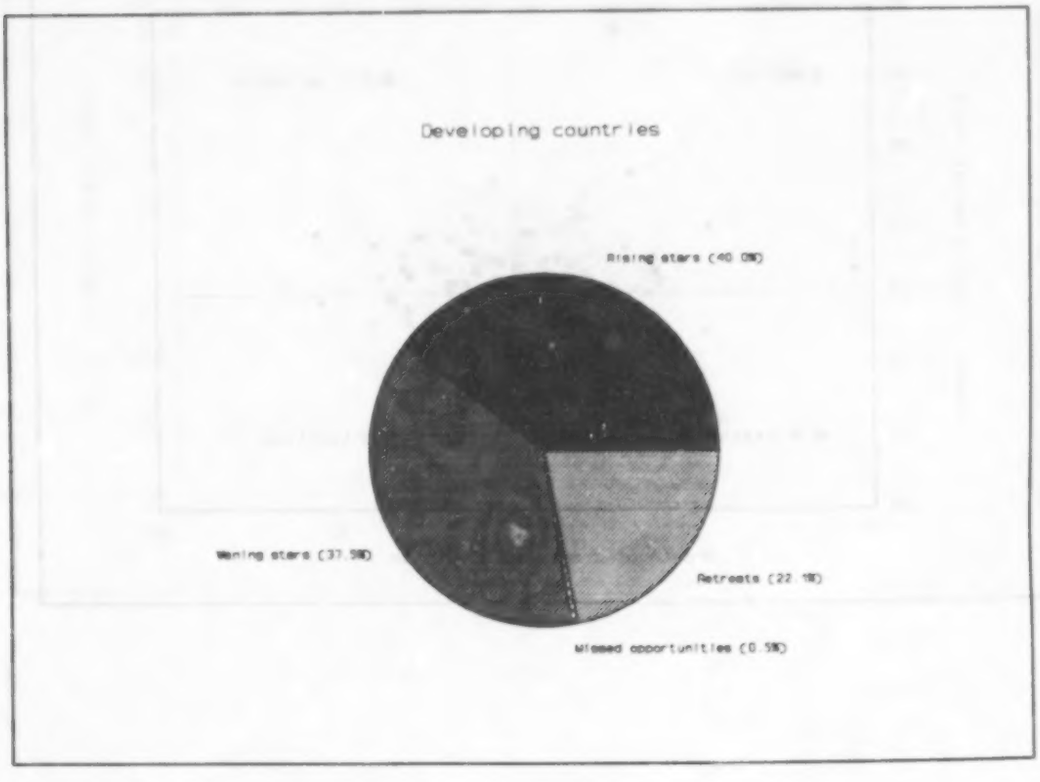

Latin America
Growth in OECD s market share
Growth of share in OECD trade
Waning stars
Rising stars
Retreats
Missed opportunities
50
40
30
20
10
0
-10
-20
-30
-40
-30
-20
-10
0
10
20
30

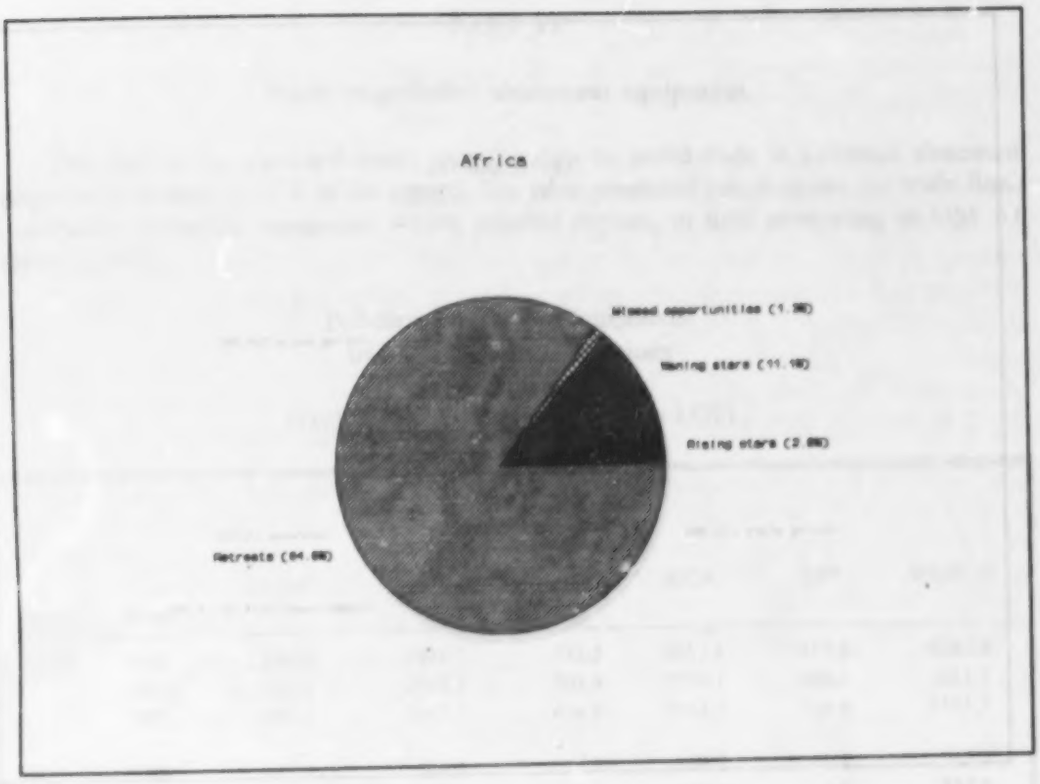

Countries with economies in transition
Growth in OECD s market share
Growth of share in OECD trade
Waning stars
Rising stars
Retreats
Missed opportunities
80
60
40
20
0
-20
-40
-60
-20
-10
0
10
20

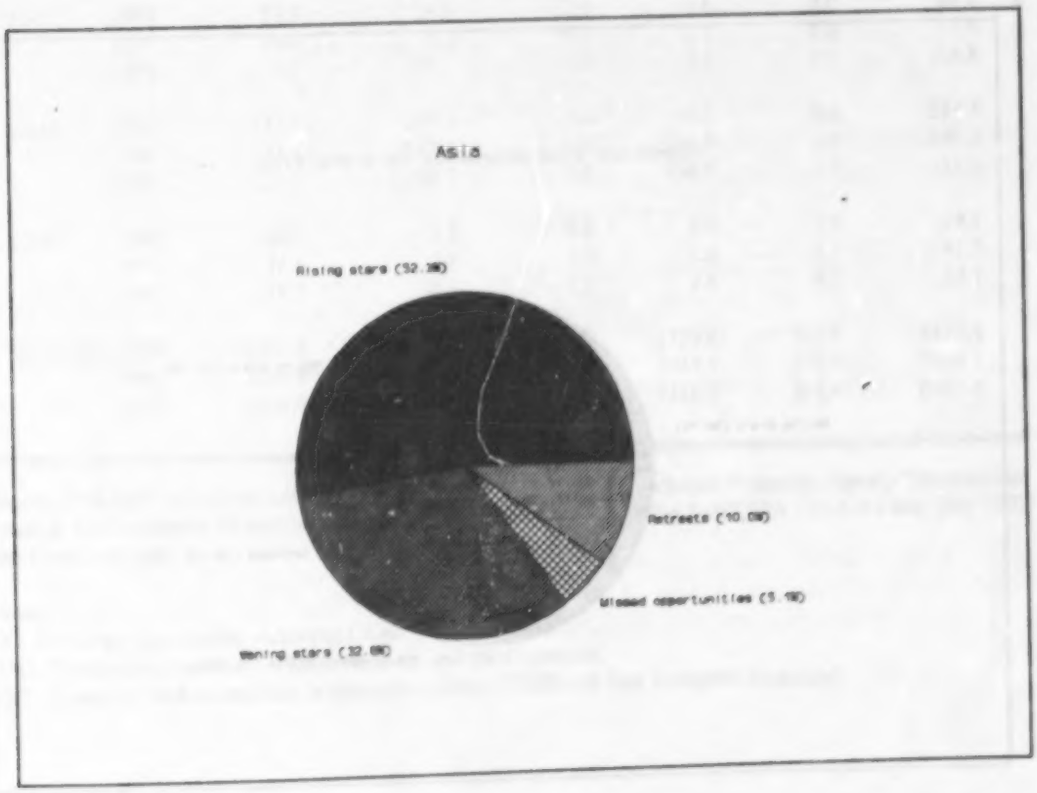
Competitiveness Matrixes: Percentage shares, 1991

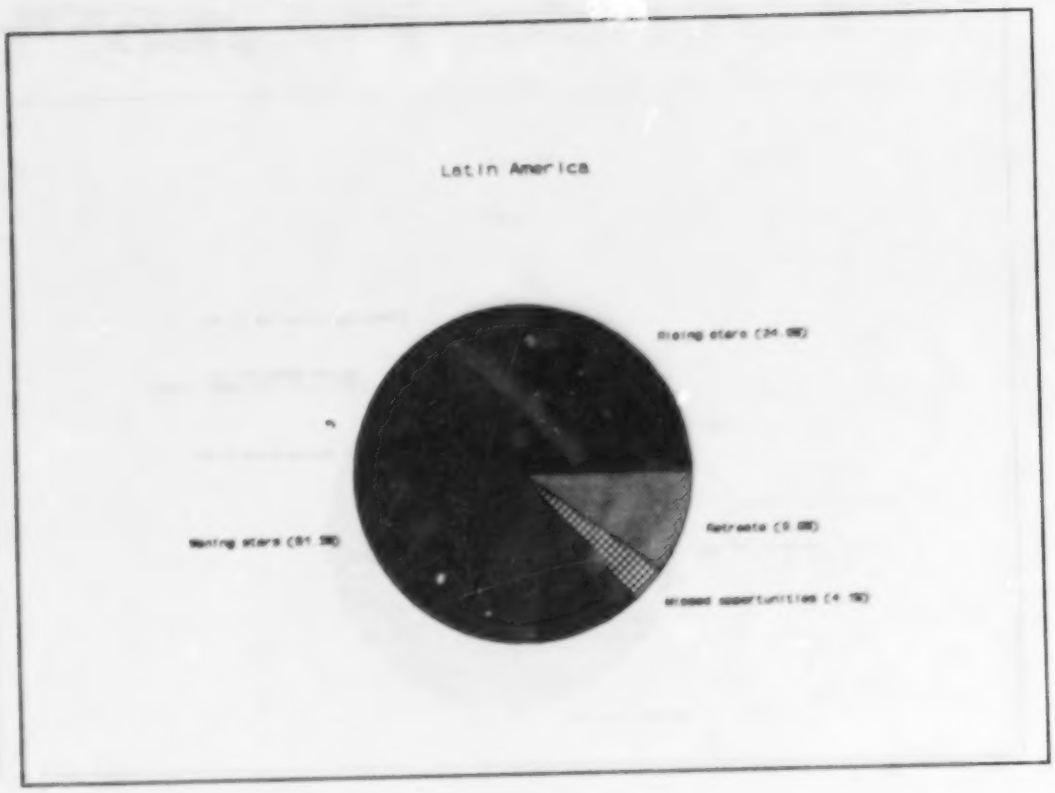
Relative importance of exports from sectors with high pollution abatement costs
(as percentage of total 1991 exports from these sectors to OECD)

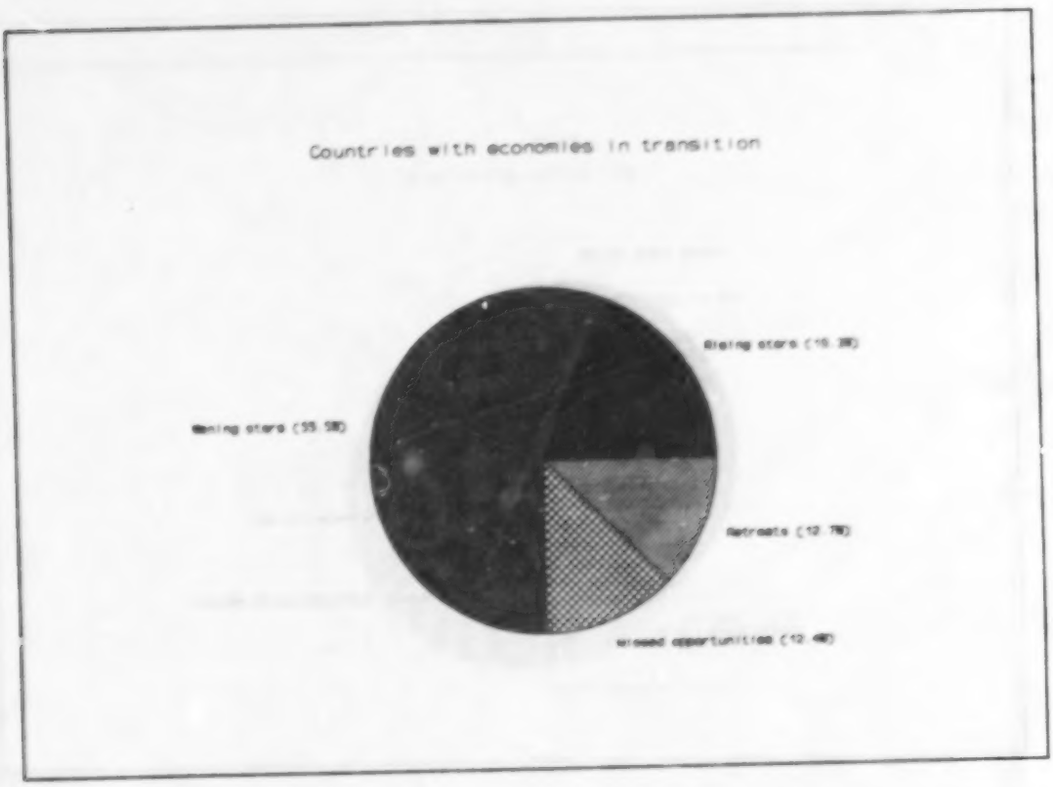





Africa
Missed opportunities (1.9%)
Waning stars (11.1%)
Rising stars (2.8%)
Retreats (84.0%)


Asia
Rising stars (52.3%)
Retreats (10.0%)
Missed opportunities (5.1%)
Waning stars (32.6%)


Latin America
Rising stars (24.0%)
Retreats (9.0%)
Missed opportunities (4.0%)
Rising stars (61.0%)


Countries with economies in transition
Rising stars (19.0%)
Rising stars (55.0%)
Retreats (12.0%)
Missed opportunities (12.0%)

PART VI

Trade in pollution abatement equipment

This part of the statistical annex provides data on world trade in pollution abatement equipment (see section IV.B of the report). The table presented below shows the trade flows in pollution abatement equipment among selected regions, in total amounting to US$ 6.6 billion in 1992.

Pollution Abatement Equipment-
trade among selected regions

(excluding intra-EU trade, million US$)

		Imports					
Exports:	Year	DMEC	DC	LAC	ASIA	CET	WORLD
DMEC	1990	2880.4	1891.2	273.2	1617.8	311.8	5083.4
	1991	3133.4	2103.7	303.9	1799.1	274.2	5511.3
	1992	3303.2	2447.5	433.9	2013.5	351.0	6101.7
DC	1990	187.7	124.4	14.0	108.2	0.1	312.2
	1991	170.4	164.4	16.6	146.4	3.0	337.8
	1992	218.2	237.9	37.2	200.4	2.7	458.8
LAC	1990	53.5	14.5	12.9	1.6	0.0	68.0
	1991	39.6	16.3	14.1	2.2	0.0	55.9
	1992	73.7	33.1	30.8	2.2	0.0	106.8
ASIA	1990	123.7	109.5	1.0	106.3	0.1	233.3
	1991	123.1	147.3	2.0	144.0	2.8	273.2
	1992	131.7	198.7	3.6	194.9	2.7	333.1
CET	1990	23.7	4.2	0.8	3.4	1.9	29.8
	1991	34.6	5.7	3.9	1.6	0.7	41.0
	1992	28.5	4.1	1.2	2.8	9.7	42.3
WORLD	1990	3091.8	2019.8	288.0	1729.4	313.8	5425.4
	1991	3338.4	2273.8	324.4	1947.1	277.9	5890.1
	1992	3550.0	2689.4	472.3	2216.7	363.4	6602.8

Source: UNCTAD secretariat calculations based on United States Environmental Protection Agency "International Trade in Environmental Protection Equipment - An Assessment of Existing Data" EPA 230-R-93-006, July 1993 and Comtrade data.

Notes:
DC: Developing countries, including China.
LAC: Developing countries in Latin America and the Caribbean.
CET: Countries with economies in transition (former USSR and East European countries).

It should be noted that it is difficult to give an accurate estimate of trade in pollution abatement equipment, particularly since trade classification systems do not conform well with statistics on pollution abatement equipment.

In a recent study by the United States Environmental Protection Agency, pollution abatement equipment was classified under tariff codes which consisted predominantly of this type of equipment.[19] On the basis of this classification, the UNCTAD secretariat converted national tariff lines to harmonized system (HS) codes. Subsequently, a concordance was drawn up with corresponding SITC codes, revision 3. The HS and corresponding SITC codes are listed below.

HS codes	SITC rev. 3	Product description of HS codes:
841780	74138	Industrial or lab furnaces & ovens, inc. incinerators non electric.
842139	74369	Filtering or purifying machinery and apparatus for gases nes.
902710	87441	Gas or smoke analysis apparatus.
842121	74361	Filtering or purifying machinery and apparatus for water.
842129	74367	Filtering or purifying machinery and apparatus for liquids nes.
842199	74395	Parts for filtering or purifying machinery & apparatus for liquids or gases.

The main limitation of these data is that most trade categories include non environmental goods besides the environmental goods. This leads, on the one hand, to over-reporting by including products that are not used by industry for environmental purposes. On the other hand, by leaving out certain categories it leads to under-reporting. Also, it should be realized that the classification does not include trade in "clean technologies" that prevent pollution rather than control it. Similarly, the analysis does not include environmental services nor pollution prevention devices that are "embodied" in traded products (e.g. catalytic converters for cars).[20]

Notes:

1. Varying definitions of pollution abatement and control expenditures among countries complicate a country specific comparison of these statistics (see also "OECD Environmental data, Compendium 1993").

2. Only former Federal Republic of Germany.

3. Due to insufficient data, the distinction between public and private sector environmental investment is not clear for these countries. China's environmental investments are expressed as a percentage of GNP. Due to lack of information, the UNCTAD secretariat estimated the years for which data is given.

4. Data collection was carried out in collaboration with the International Environmental Data Service (IEDS) of the United Nations Economic Commission for Europe (ECE) who contacted national statistical offices and organised the data collection and presentation of the tabels on pollution abatement costs and capital expenditures for the manufacturing industries (ISIC Rev.2) of five selected developed market economies; Canada, France, Germany, the Netherlands and Sweden. On the basis of national statistical information sources, the UNCTAD secretariat estimated the pollution abatement costs of three additional countries: Australia, Japan and the United States.

5. See also: U.S. Congress, Office of Technology Assessment, "Industry, Technology, and the Environment-Competitive Challenges and Business Opportunities", 1994, Appendix 7-A: Possible sources of under-reporting of pollution abatement costs.

6. OECD, "Pollution Abatement and Control Expenditure in OECD Countries", OECD Environment Monographs No. 75, OCDE/GD (93)91, Paris 1993.

7. Source: UNCTAD calculations on the basis of Australian Bureau of Statistics, "Cost of environment protection, Australia - Selected industries, 1990-91", ABS Catalogue No. 4403.0, and; OECD, Industrial Statistics, 1992.

Australian statistics on environmental and total expenditures do not use the ISIC classification of manufacturing industries. The UNCTAD secretariat estimated the expenditures corresponding to ISIC headings on the basis of the data derived from national statistics.

8. For Canada, total environmental expenditures (investments and current) are calculated as the sum of expenditures on air & climate, waste-water and soil & groundwater. ISIC heading 34 only includes the pulp and paper industry and ISIC heading 35 only includes petroleum, coal and chemicals.

9. Source for total investments and production: OECD, Industrial Structure Statistics, 1992.

10. Source for total investments and production: OECD, Industrial Structure Statistics, 1992.

11. Source: Japanese Ministry of International Trade and Industry "Investment trends in plants and equipment in major industries" (UNCTAD translation), Heisei 5, 1993.

Japanese statistics on environmental and total expenditures are not expressed in the ISIC classification of manufacturing industries. The UNCTAD secretariat estimated the expenditures corresponding to ISIC headings on the basis of the data derived from national statistics.

12. Source: For total investments and production: OECD, Industrial Structure Statistics, 1992.

13. Data for the table of Sweden is based on information of industrial establishments with a yearly average number of employers greater than 10 persons.

14. Source: UNCTAD calculations, on the basis of: U.S. Department of Commerce Economics and Statistics Administration, Bureau of the Census, "Pollution abatement costs and expenditures, 1991", January 1993 and U.S. Department of Commerce, Bureau of the Census "1991 Annual survey of manufactures - Value of product shipments", November 1992.

15. Data obtained from U.S. Department of Commerce op. cit.

16. Mandeng, O.J. "International competitiveness and specialization", CEPAL Review No. 45, December 1991.

17. Algebraically this is defined as: product share$_j$=(M_{jw}/M_{tw}) where M is import, j is product, t is total, w is the market, i.e. OECD.

18. Algebraically this is defined as: market share$_j$=(M_{ji}/M_{jw}) where M is import, j is product, i is region, w is the market, i.e. OECD.

19. United States Environmental Protection Agency "International Trade in Environmental Protection Equipment - An Assessment of Existing Data" EPA 230-R-93-006, July 1993.

20. United States Environmental Protection Agency op. cit.